Nokia Customer Care

Service Manual

RM-242 (Nokia 5610 XpressMusic)

Mobile Terminal

Part No: (Issue 1)

COMPANY CONFIDENTIAL

Amendment Record Sheet

Amendment No	Date	Inserted By	Comments
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The availability of particular products may vary by region.

IMPORTANT

This document is intended for use by qualified service personnel only.

Warnings and cautions

Warnings

- IF THE DEVICE CAN BE INSTALLED IN A VEHICLE, CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI-SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/ MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
- THE PRODUCT MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES, FOR EXAMPLE, PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
- OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
- BEFORE MAKING ANY TEST CONNECTIONS, MAKE SURE YOU HAVE SWITCHED OFF ALL EQUIPMENT.

Cautions

- Servicing and alignment must be undertaken by qualified personnel only.
- Ensure all work is carried out at an anti-static workstation and that an anti-static wrist strap is worn.
- Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
- Use only approved components as specified in the parts list.
- Ensure all components, modules, screws and insulators are correctly re-fitted after servicing and alignment.
- Ensure all cables and wires are repositioned correctly.
- Never test a mobile phone WCDMA transmitter with full Tx power, if there is no possibility to perform the measurements in a good performance RF-shielded room. Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.
- During testing never activate the GSM or WCDMA transmitter without a proper antenna load, otherwise GSM or WCDMA PA may be damaged.

For your safety

QUALIFIED SERVICE

Only qualified personnel may install or repair phone equipment.

ACCESSORIES AND BATTERIES

Use only approved accessories and batteries. Do not connect incompatible products.

CONNECTING TO OTHER DEVICES

When connecting to any other device, read its user's guide for detailed safety instructions. Do not connect incompatible products.

Care and maintenance

This product is of superior design and craftsmanship and should be treated with care. The suggestions below will help you to fulfil any warranty obligations and to enjoy this product for many years.

- Keep the phone and all its parts and accessories out of the reach of small children.
- Keep the phone dry. Precipitation, humidity and all types of liquids or moisture can contain minerals that will corrode electronic circuits.
- Do not use or store the phone in dusty, dirty areas. Its moving parts can be damaged.
- Do not store the phone in hot areas. High temperatures can shorten the life of electronic devices, damage batteries, and warp or melt certain plastics.
- Do not store the phone in cold areas. When it warms up (to its normal temperature), moisture can form inside, which may damage electronic circuit boards.
- Do not drop, knock or shake the phone. Rough handling can break internal circuit boards.
- Do not use harsh chemicals, cleaning solvents, or strong detergents to clean the phone.
- Do not paint the phone. Paint can clog the moving parts and prevent proper operation.
- Use only the supplied or an approved replacement antenna. Unauthorised antennas, modifications or attachments could damage the phone and may violate regulations governing radio devices.

All of the above suggestions apply equally to the product, battery, charger or any accessory.

ESD protection

Nokia requires that service points have sufficient ESD protection (against static electricity) when servicing the phone.

Any product of which the covers are removed must be handled with ESD protection. The SIM card can be replaced without ESD protection if the product is otherwise ready for use.

To replace the covers ESD protection must be applied.

All electronic parts of the product are susceptible to ESD. Resistors, too, can be damaged by static electricity discharge.

All ESD sensitive parts must be packed in metallized protective bags during shipping and handling outside any ESD Protected Area (EPA).

Every repair action involving opening the product or handling the product components must be done under ESD protection.

ESD protected spare part packages MUST NOT be opened/closed out of an ESD Protected Area.

For more information and local requirements about ESD protection and ESD Protected Area, contact your local Nokia After Market Services representative.

Battery information

Note: A new battery's full performance is achieved only after two or three complete charge and discharge cycles!

The battery can be charged and discharged hundreds of times but it will eventually wear out. When the operating time (talk-time and standby time) is noticeably shorter than normal, it is time to buy a new battery.

Use only batteries approved by the phone manufacturer and recharge the battery only with the chargers approved by the manufacturer. Unplug the charger when not in use. Do not leave the battery connected to a charger for longer than a week, since overcharging may shorten its lifetime. If left unused a fully charged battery will discharge itself over time.

Temperature extremes can affect the ability of your battery to charge.

For good operation times with Ni-Cd/NiMh batteries, discharge the battery from time to time by leaving the product switched on until it turns itself off (or by using the battery discharge facility of any approved accessory available for the product). Do not attempt to discharge the battery by any other means.

Use the battery only for its intended purpose.

Never use any charger or battery which is damaged.

Do not short-circuit the battery. Accidental short-circuiting can occur when a metallic object (coin, clip or pen) causes direct connection of the + and - terminals of the battery (metal strips on the battery) for example when you carry a spare battery in your pocket or purse. Short-circuiting the terminals may damage the battery or the connecting object.

Leaving the battery in hot or cold places, such as in a closed car in summer or winter conditions, will reduce the capacity and lifetime of the battery. Always try to keep the battery between 15°C and 25°C (59°F and 77°F). A phone with a hot or cold battery may temporarily not work, even when the battery is fully charged. Batteries' performance is particularly limited in temperatures well below freezing.

Do not dispose of batteries in a fire!

Dispose of batteries according to local regulations (e.g. recycling). Do not dispose as household waste.

Company Policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Business Group should be notified in writing/e-mail.

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Nokia 5610 XpressMusic Service Manual Structure

1 General information
2 Service Devices and Service Concepts
3 BB Troubleshooting and Manual Tuning Guide
4 RF troubleshooting
5 System Module
Glossary

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1 — General information

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Product selection

RM-242 (Nokia 5610 XpressMusic) is a WCDMA/GSM dual mode phone, supporting WCDMA 850/2100 bands and EGSM850/900/1800/1900 bands.

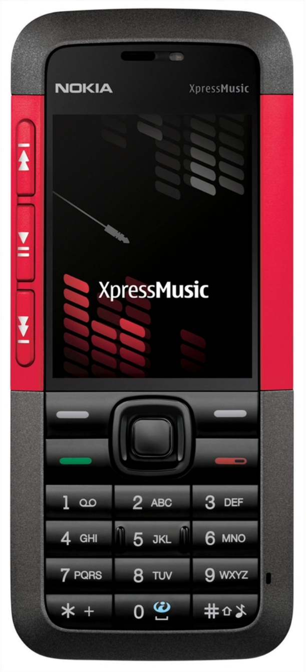

Figure 1 RM-242 (Nokia 5610 XpressMusic) product picture

Phone features

Display and keypad features

- 2.2” 240x320 pixel, 16M colour display (33.5mm x 44.7mm active area)
- Ambient light sensor
- 5-way , navi-key (2 soft-keys, call and end keys)

Hardware features

- 3.2-megapixel auto focus camera with 8x digital zoom and double LED flash
- Secondary camera for video calls
- 2.5mm AV connector for headset
- Micro USB port for data transfer (USB 2.0)
- Bluetooth (version 2.0)
- RDS Stereo radio and music player
- Internal vibrator and antenna
- Plug-in SIM (1.8 V and 3.0 V)
- MicroSD card slot (up to 4GM)
- Two way spring loaded MusicSlider music key
- Side volume keys with zoom functionality
- DAC33 audio ship (for better audio and palyback

RF features

- WCDMA Band I (2100) & V (850)
- GSM/EDGE 850/900/1800/1900
- EDGE: MSC 31
- GPRS: MSC 31
- CSD

User interface and software features

Selection of software applications and services

- Audio messages
- 3GPP streaming / downloading video
- XHTML browsing over TCP/IP
- Themes (wallpapers, icons, colors)
- Music Player supporting MP3, MP4, AAC, ACC+, eAAC+ and WMA
- Nokia Xpress audio messaging (AMS)
- OMA DRM 2.0 (Digital Right Management)
- OMA MMS 1.2, MMS Conformance 3.0, AMR and SMIL
- OMA Client Provisioning v1.1
- Java
- 64 polyphonic ringing tones
- Video ringing tones
- WAP 2.0, XHTML browser over HTTP/TCP/IP stack
- SyncML (local and remote)
- Nokia PC Suite and Nokia Music Manager

Accessories

Sales package contents

- Nokia 5610 phone
- Nokia Battery BP-5M
- Nokia Charger: AC-4
- Micro SD memory card: MU-28 or MU-22 (area dependent)
- Nokia wired headset: HS-45 (with Ad56 remote control)
- USB cable CA-101
- CD rom
- User Guide

Table 1 Battery and chargers

Type	Name
Note: This phone is charged through the smaller charger Nokia standard interface (2.mm plug). The standard 3.5mm standard charger can be used together with the CA-44 charger adapter.	

Type	Name
AC-4	Charger
BP-5M	Battery 900 mAh Li-Ion

Table 2 Headsets

Type	Name
Wired	
HS-45	Headset (wired)

Table 3 Data cables

Type	Name
CA-101	Micro USB cable

Technical specifications

General specifications

Unit	Dimension (mm)	Weight (g)	Volume (cc)
Transceiver with BP-5M 900 mAh Li-Ion battery pack	111 x 48.5 x 17	111	75

Battery endurance

Battery	NMP Talk time	NMP Standby time
BP-5M 900 mAh Li-ion	Up to 6Hours	13.5 Days

Note: Variation in operation times will occur depending on SIM card, network settings and usage.

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2 — Service Devices and Service Concepts

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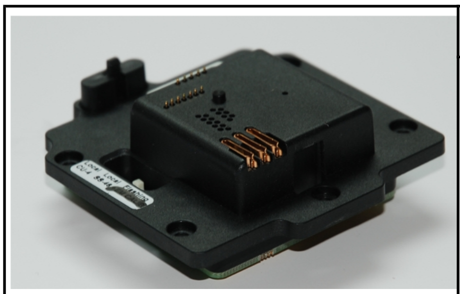
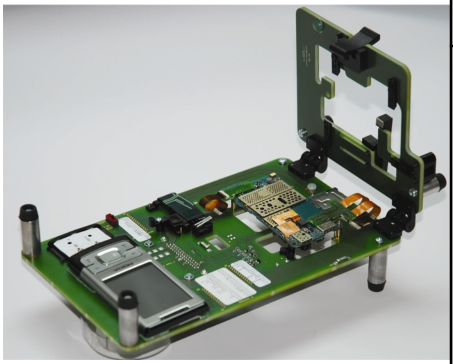
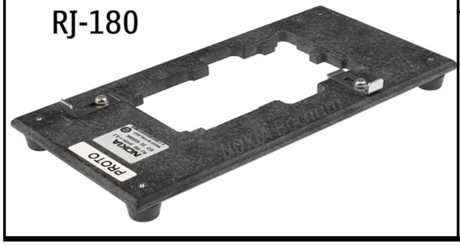
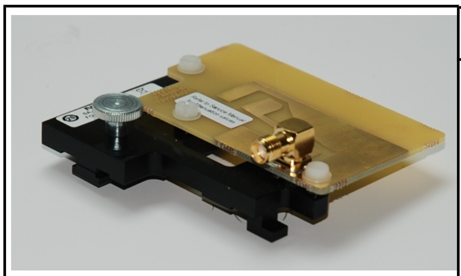
Service devices

Product specific devices

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-242, refer to various concepts.

<table>
<tr><td rowspan="2"></td><td>FS-59</td><td>Flash adapter</td><td></td></tr>
<tr><td colspan="3">• FS-59 is equipped with a clip interlock system
• provides standardised interface towards Control Unit
• provides RF connection using coupler
• multiplexing between USB and FBUS media, controlled by VUSB</td></tr>
<tr><td rowspan="2"></td><td>MJ-136</td><td>Module jig</td><td></td></tr>
<tr><td colspan="3">MJ-136 is meant for component level troubleshooting.
The jig includes an RF interface for GSM, WCDMA and Bluetooth. In addition, it has the following features:
• Provides mechanical interface with the engine module
• Provides galvanic connection to all needed test pads in module
• Multiplexing between USB and FBUS media, controlled by Vusb
• MMC interface
• Duplicated SIM connector
• Connector for control unit
• Access for AV- and USB connectors
Note: A short user guide is given together with the Module jig service concept in the end of this chapter.</td></tr>
<tr><td rowspan="2">RJ-180
</td><td>RJ-180</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-180 is a jig used for soldering and as a rework jig for the engine module.</td></tr>
</table>

	SA-149	RF coupler	

SA-149 is an RF coupler for WCDMA and GSM RF testing. It is used together with SS-46 and SS-62.

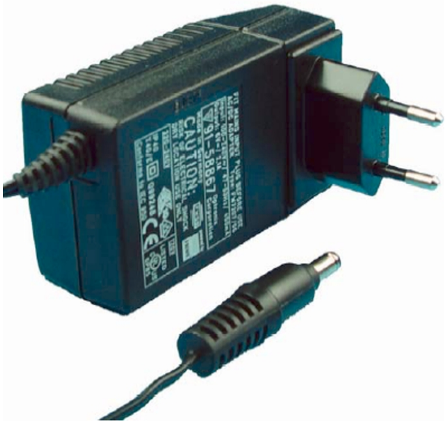
The following table shows attenuations from the antenna pads of the mobile terminal to the SMA connectors of SA-149:

-

Frequency	Att. (dB)
GSM850 TX	Low: 11.5 Mid: 11.4 High: 9.4
GSM850 RX	Low: 7.2 Mid: 6.9 High: 6.9
GSM900 TX	Low: 6.9 Mid: 7.1 High: 7.3
GSM900 RX	Low: 7.1 Mid: 6.9 High: 6.8
GSM1800 TX	Low: 6.9 Mid: 7.5 High: 8.2
GSM1800 RX	Low: 8.3 Mid: 9.2 High: 9.2
GSM1900 TX	Low: 9.3 Mid: 9.2 High: 8.8
GSM1900 RX	Low: 8.5 Mid: 8.4 High: 8.4
WCDMA850 TX	Low: 11.6 Mid: 11.4 High: 9.7
WCDMA850 RX	Low: 7.1 Mid: 6.9 High: 6.9
WCDMA1920 TX	Low: 8.6 Mid: 8.4 High: 8.3
WCDMA1920 RX	Low: 11.7 Mid: 12.1 High: 11.3

General devices

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-242, refer to various concepts.

	AC-33	Power supply	
	Universal power supply for FPS-10; included in the FPS-10 sales package.		
	ACF-8	Universal power supply	
	ACF-8 universal power supply is used to power FPS-8. ACF-8 has 6V DC and 2.1A output.		

CU-4	Control unit	

CU-4 is a general service tool used with a module jig and/or a flash adapter. It requires an external 12 V power supply.

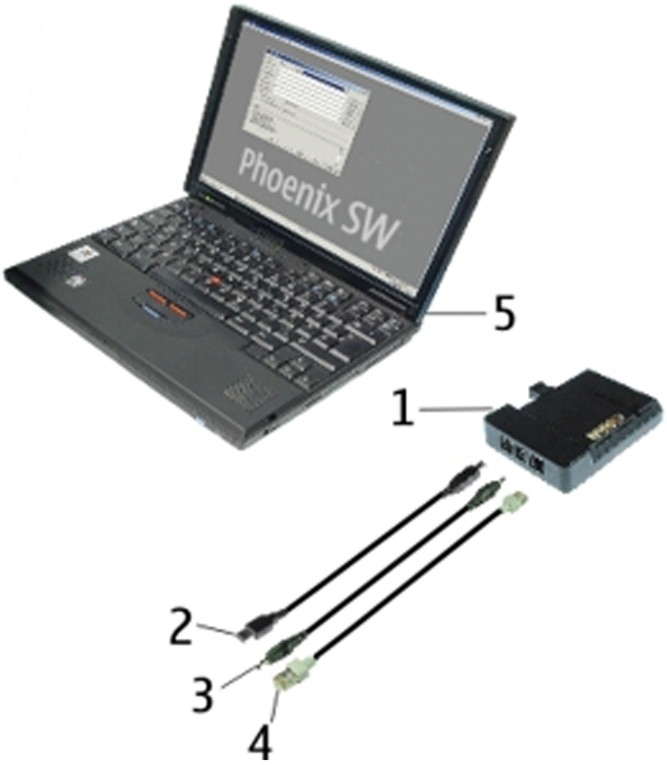
The unit has the following features:

- software controlled via USB
- EM calibration function
- Forwards FBUS/Flashbus traffic to/from terminal
- Forwards USB traffic to/from terminal
- software controlled BSI values
- regulated VBATT voltage
- 2 x USB2.0 connector (Hub)
- FBUS and USB connections supported

When using CU-4, note the special order of connecting cables and other service equipment:

Instructions

1. Connect a service tool (jig, flash adapter) to CU-4.
2. Connect CU-4 to your PC with a USB cable.
3. Connect supply voltage (12 V)
4. Connect an FBUS cable (if necessary).
5. Start Phoenix service software.



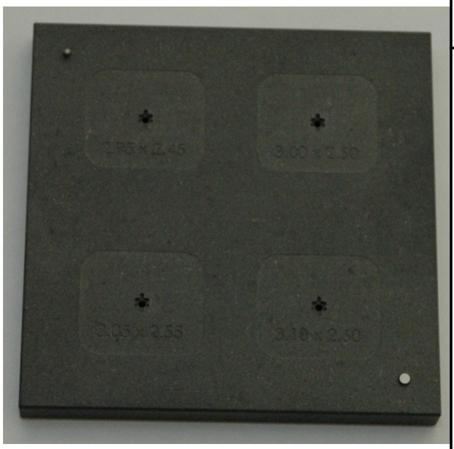
Note: Phoenix enables CU-4 regulators via USB when it is started.

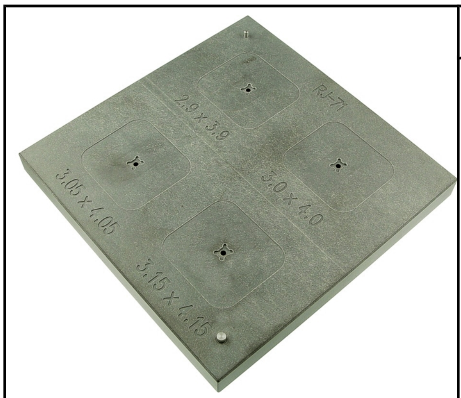
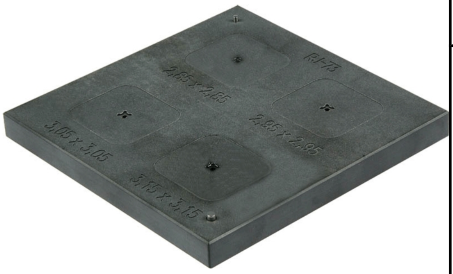
Reconnecting the power supply requires a Phoenix restart.

<table>
<tr><td rowspan="2"> </td><td>FLS-4S</td><td>Flash device</td><td></td></tr>
<tr><td colspan="3">FLS-4S is a dongle and flash device incorporated into one package, developed specifically for POS use.</td></tr>
<tr><td rowspan="2"> </td><td>FLS-5</td><td>Flash device</td><td></td></tr>
<tr><td colspan="3">FLS-5 is a dongle and flash device incorporated into one package, developed specifically for POS use.
Note: FLS-5 can be used as an alternative to PKD-1.</td></tr>
<tr><td rowspan="2"> </td><td>FPS-10</td><td>Flash prommer</td><td></td></tr>
<tr><td colspan="3">FPS-10 interfaces with:
• PC
• Control unit
• Flash adapter
• Smart card
FPS-10 flash prommer features:
• Flash functionality for BB5 and DCT-4 terminals
• Smart Card reader for SX-2 or SX-4
• USB traffic forwarding
• USB to FBUS/Flashbus conversion
• LAN to FBUS/Flashbus and USB conversion
• Vusb output switchable by PC command
FPS-10 sales package includes:
• FPS-10 prommer
• Power Supply with 5 country specific cords
• USB cable
Note: FPS-21 is substitute FPS-10 if FPS-10 has not been set up.</td></tr>
</table>

<table>
<tr><td rowspan="2">
DESkey
www.des.co.uk

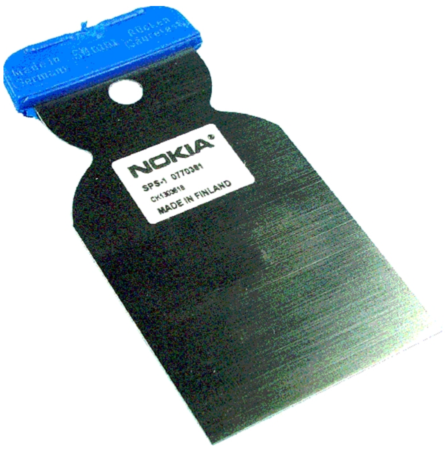
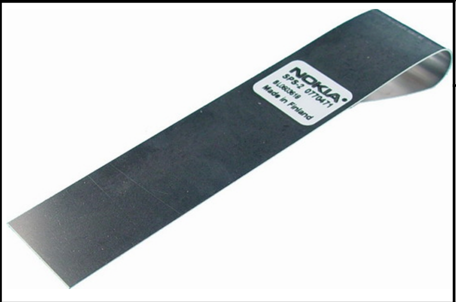
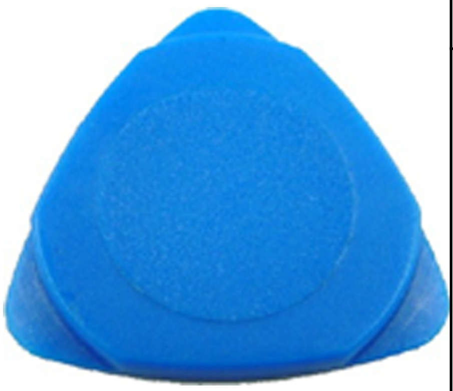
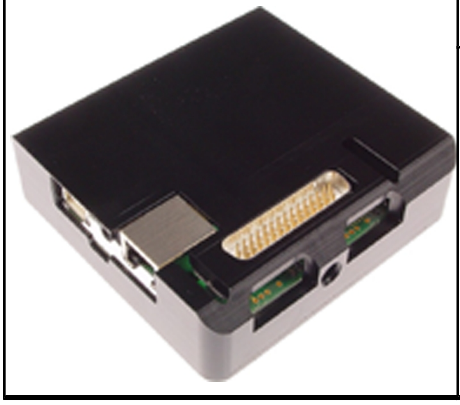
</td><td>PK-1</td><td>Software protection key</td><td></td></tr>
<tr><td colspan="3">PK-1 is a hardware protection key with a USB interface. It has the same functionality as the PKD-1 series dongle.
PK-1 is meant for use with a PC that does not have a series interface.
To use this USB dongle for security service functions please register the dongle in the same way as the PKD-1 series dongle.</td></tr>
<tr><td rowspan="2">
DESkey
www.des.co.uk

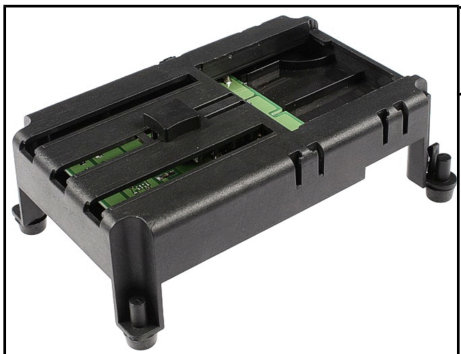
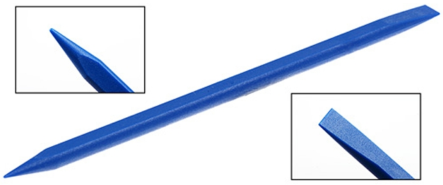
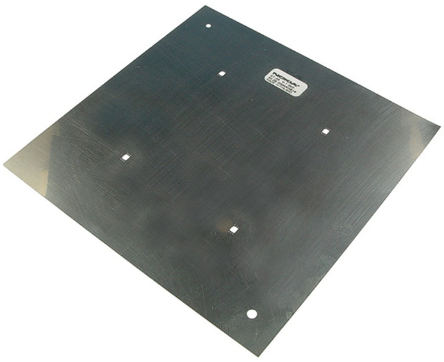
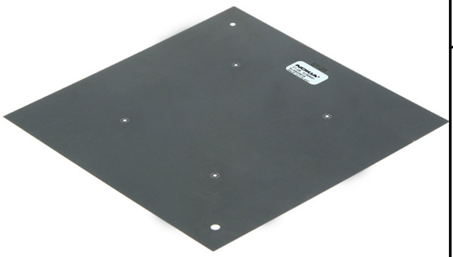
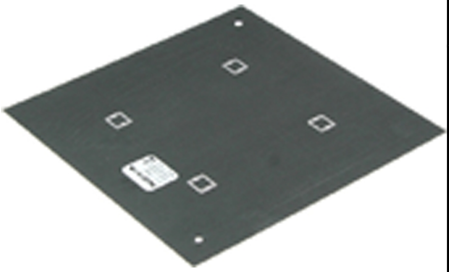
</td><td>PKD-1</td><td>SW security device</td><td></td></tr>
<tr><td colspan="3">SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC.
Without the device, it is not possible to use the service software.
Printer or any such device can be connected to the PC through the device if needed.</td></tr>
<tr><td rowspan="2"></td><td>RJ-157</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-157 is a jig used for soldering and as a rework jig for the engine module. It is used together with the ST-55 stencil.</td></tr>
<tr><td rowspan="2"> </td><td>RJ-184</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-184 is used as a rework jig for the engine module.
This jig is used in conjunction with the ST-61 stencil for spreading the soldering paste to the B2201 component.</td></tr>
<tr><td rowspan="2"> </td><td>RJ-196</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-196 is a rework jig used when servicing the BTHFM (D6000) module. It is used together with rework stencil ST-37.</td></tr>
</table>

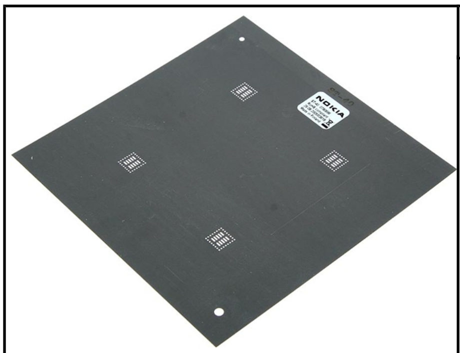
<table>
<tr><td rowspan="2"> </td><td>RJ-71</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-71 is a rework jig used with ST-26 rework stencil.</td></tr>
<tr><td rowspan="2"></td><td>RJ-73</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-73 is a rework jig used with ST-29.</td></tr>
<tr><td rowspan="2"> </td><td>RJ-93</td><td>Rework jig</td><td></td></tr>
<tr><td colspan="3">RJ-93 is used as a rework jig for the engine module.
This stencil takes the front end module (FEM) or power amplifier (PA) module for spreading the soldering paste to the component. Must be used together with the ST-40 stencil.</td></tr>
<tr><td rowspan="2">

NOKIA
RF-IO
CLASS 1
STATUS
BER TEST
FBUS
POWER

</td><td>SB-6</td><td>Bluetooth test and interface box (sales package)</td><td></td></tr>
<tr><td colspan="3">The SB-6 test box is a generic service device used to perform Bluetooth bit error rate (BER) testing, and establishing cordless FBUS connection via Bluetooth. An ACP-8x charger is needed for BER testing and an AXS-4 cable in case of cordless interface usage testing .
Sales package includes:
• SB-6 test box
• Installation and warranty information</td></tr>
</table>

	SPS-1	Soldering Paste Spreader	
	The SPS-1 allows spreading of solder to the LGA components pads over the rework stencils.		
	SPS-2	Soldering paste spreader	
	SRT-6	Opening tool	
	SRT-6 is used to open phone covers.		
	SS-46	Interface adapter	
	SS-46 acts as an interface adapter between the flash adapter and FPS-10.		

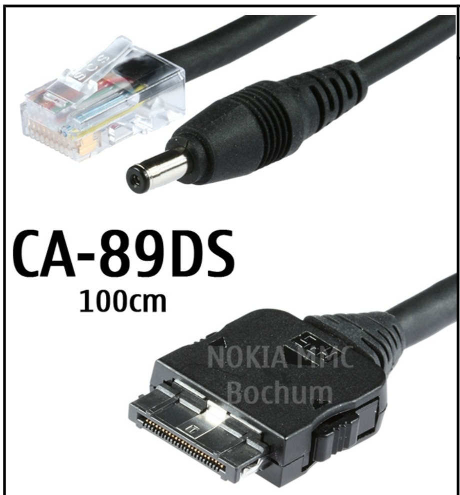
<table>
<tr><td rowspan="2"></td><td>SS-62</td><td>Generic flash adapter base for BB5</td><td></td></tr>
<tr><td colspan="3">• generic base for flash adapters and couplers
• SS-62 equipped with a clip interlock system
• provides standardised interface towards Control Unit
• provides RF connection using galvanic connector or coupler
• multiplexing between USB and FBUS media, controlled by VUSB</td></tr>
<tr><td rowspan="2"></td><td>SS-93</td><td>Opening tool</td><td></td></tr>
<tr><td colspan="3">SS-93 is used for opening JAE connectors.</td></tr>
<tr><td rowspan="2"></td><td>ST-26</td><td>Rework stencil</td><td></td></tr>
<tr><td colspan="3">ST-26 is a rework stencil used with rework jig RJ-71.</td></tr>
<tr><td rowspan="2"></td><td>ST-29</td><td>rework stencil</td><td></td></tr>
<tr><td colspan="3">This stencil is to be used together with RJ-73.</td></tr>
<tr><td rowspan="2"></td><td>ST-37</td><td>BTHFM rework stencil</td><td></td></tr>
<tr><td colspan="3">ST-37 stencil is used with the RJ-104 rework jig to service the BTHFM (D6000) module.</td></tr>
</table>

	ST-40	Rework stencil	
	ST-40 is a rework stencil and used with RJ-93.		
	ST-55	Rework stencil	
	ST-55 is a rework stencil used when servicing the Z7540 and Z7541 duplexers. It is used together with the rework jigs RJ-157 and RJ-160.		
	ST-61	Rework stencil	
	ST-61 is a rework stencil and used with RJ-184.		
	SX-4	Smart card	
	SX-4 is a BB5 security device used to protect critical features in tuning and testing. SX-4 is also needed together with FPS-10 when DCT-4 phones are flashed.		

Cables

The table below gives a short overview of service tools that can be used for testing, error analysis and repair of product RM-242, refer to various concepts.

	CA-28DS	Service data cable	
	The CA-28DS service cable is used to connect FLS-4S to the POS flash adapter for supplying a controlled operating voltage and data connection.		
	CA-31D	USB cable	
	The CA-31D USB cable is used to connect FPS-10 or FPS-11 to a PC. It is included in the FPS-10 and FPS-11 sales packages.		
	CA-35S	Power cable	
	CA-35S is a power cable for connecting, for example, the FPS-10 flash prommer to the Point-Of-Sales (POS) flash adapter.		

<table>
<tr><td rowspan="2">
</td><td>CA-89DS</td><td>Cable</td><td></td></tr>
<tr><td colspan="3"></td></tr>
<tr><td rowspan="2"> </td><td>CA-92U</td><td>AV cable</td><td></td></tr>
<tr><td colspan="3">The CA-92U is a AV cable that i used to connect the AV connecter (2.5mm) on the phone to an AV device (RCA connectors).</td></tr>
<tr><td rowspan="2"> </td><td>DAU-9S</td><td>MBUS cable</td><td></td></tr>
<tr><td colspan="3">The MBUS cable DAU-9S has a modular connector and is used, for example, between the PC's serial port and module jigs, flash adapters or docking station adapters.
Note: Only ROHS compliant version GM 30083821 allowed.
Note: Docking station adapters valid for DCT4 products.</td></tr>
<tr><td rowspan="2"> </td><td>PCS-1</td><td>Power cable</td><td></td></tr>
<tr><td colspan="3">The PCS-1 power cable (DC) is used with a docking station, a module jig or a control unit to supply a controlled voltage.</td></tr>
</table>

	XCS-4	Modular cable	
	XCS-4 is a shielded (one specially shielded conductor) modular cable for flashing and service purposes.		
	XRS-6	RF cable	
	The RF cable is used to connect, for example, a module repair jig to the RF measurement equipment. SMA to N-Connector approximately 610 mm. Attenuation for: • GSM850/900: 0.3+-0.1 dB • GSM1800/1900: 0.5+-0.1 dB • WLAN: 0.6+-0.1dB		

Service concepts

POS (Point of Sale) flash concept

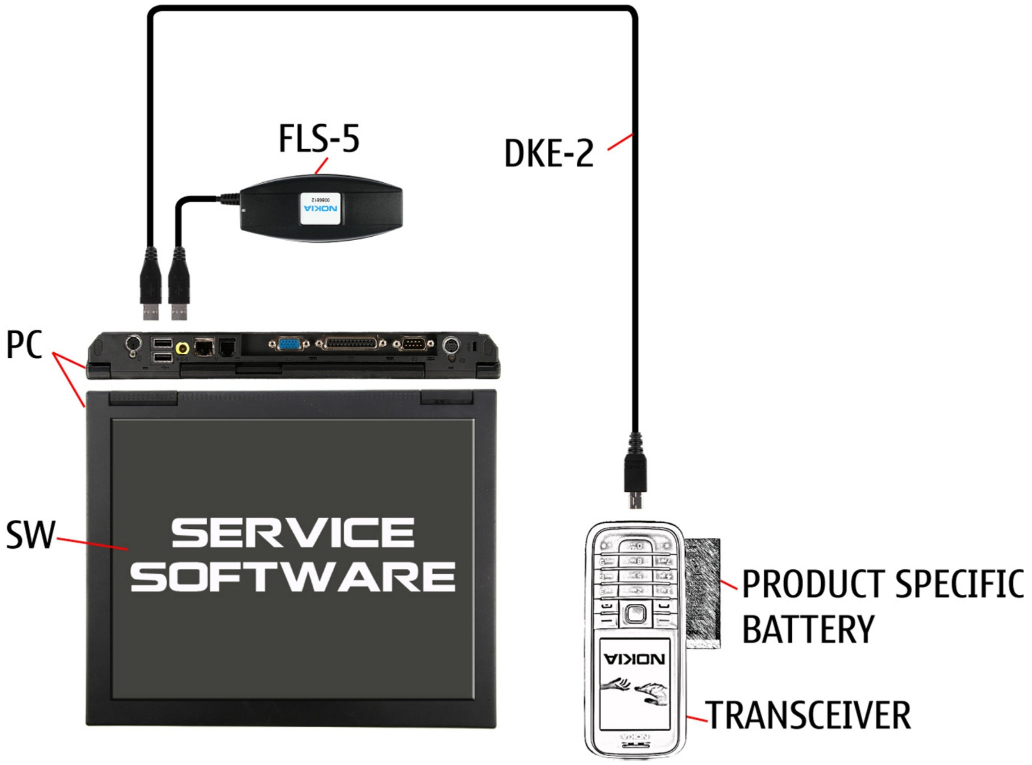

FLS-5
DKE-2
PC
SW
SERVICE SOFTWARE
PRODUCT SPECIFIC BATTERY
TRANSCEIVER

Figure 2 POS flash concept

Type	Description
Product specific tools	
BP-5C	Battery
Other tools	
FLS-5	POS flash dongle
	PC with Phoenix service software
Cables	
DKE-2	USB connectivity cable

Flash concept with FPS-10

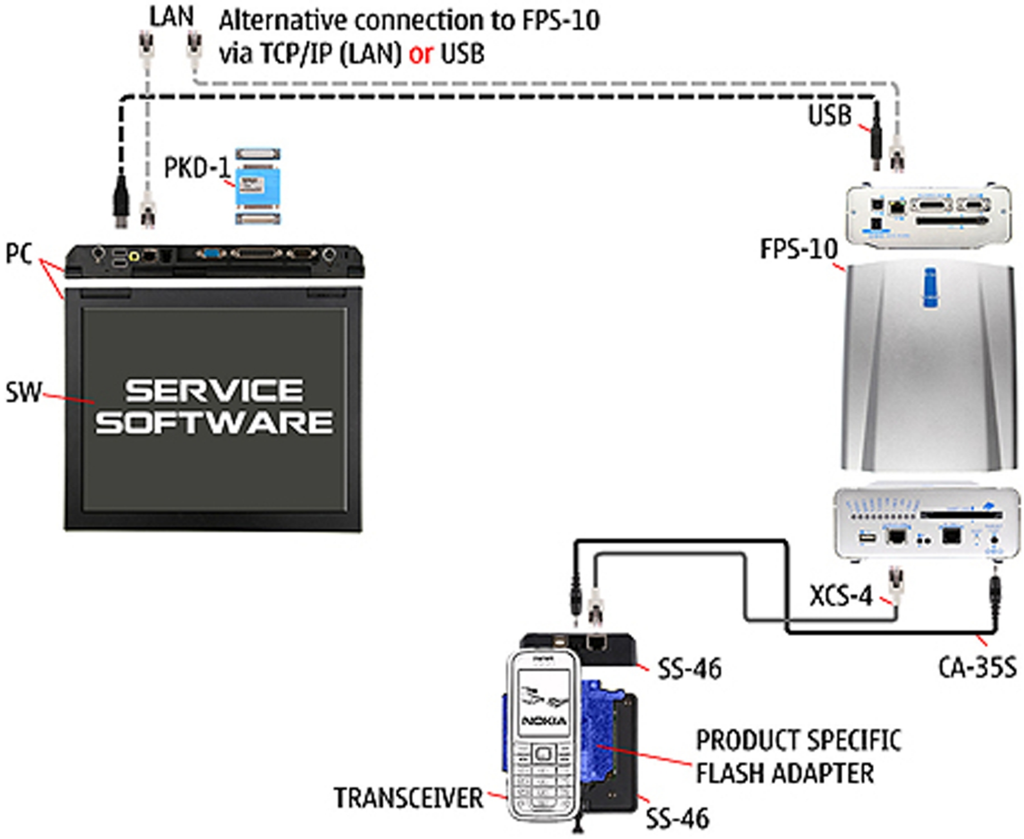

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
PKD-1
PC
FPS-10
SW
SERVICE
SOFTWARE
XCS-4
SS-46
CA-35S
PRODUCT SPECIFIC
FLASH ADAPTER
TRANSCEIVER
SS-46

Figure 3 Basic flash concept with FPS-10

Type	Description
Product specific devices	
FS-53	Flash adapter
Other devices	
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-46	Interface adapter
	PC with Phoenix service software
Cables	
XCS-4	Modular cable
CA-35S	Power cable
	USB cable

CU-4 flash concept with FPS-10

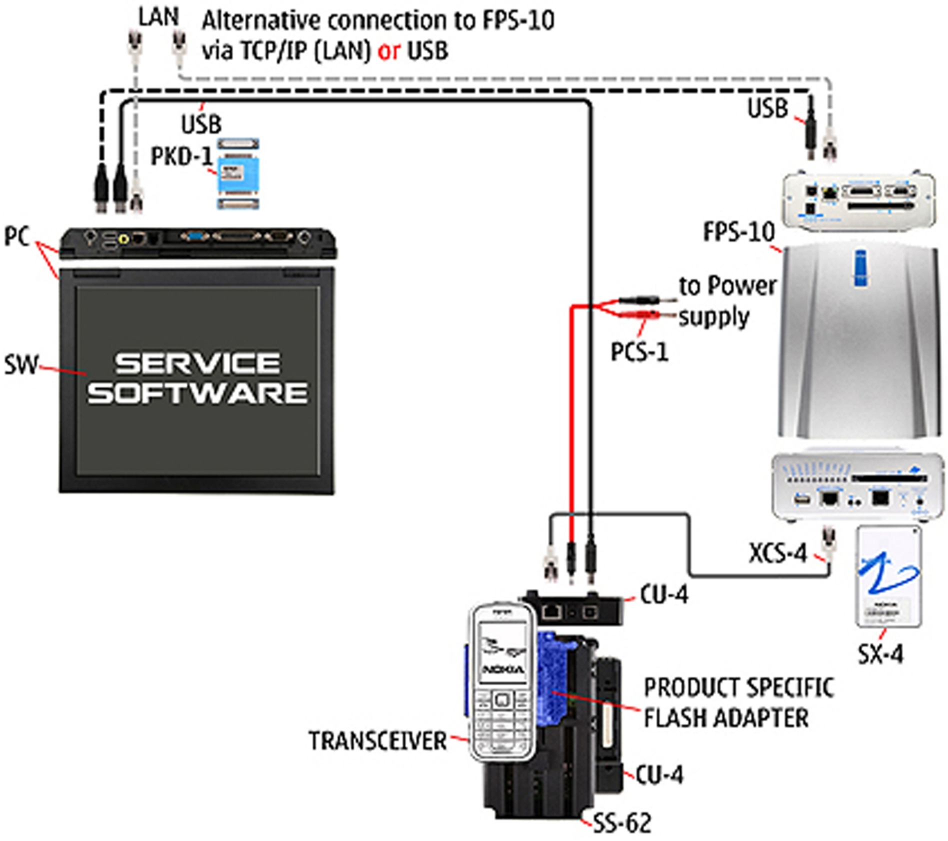

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
USB
USB
PKD-1
PC
SW
SERVICE SOFTWARE
FPS-10
to Power supply
PCS-1
XCS-4
CU-4
SX-4
PRODUCT SPECIFIC FLASH ADAPTER
TRANSCEIVER
CU-4
SS-62

Figure 4 CU-4 flash concept with FPS-10

Type	Description
Product specific devices	
FS-53	Flash adapter
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
SX-4	Smart card
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
	Standard USB cable
	USB cable

Module jig service concept

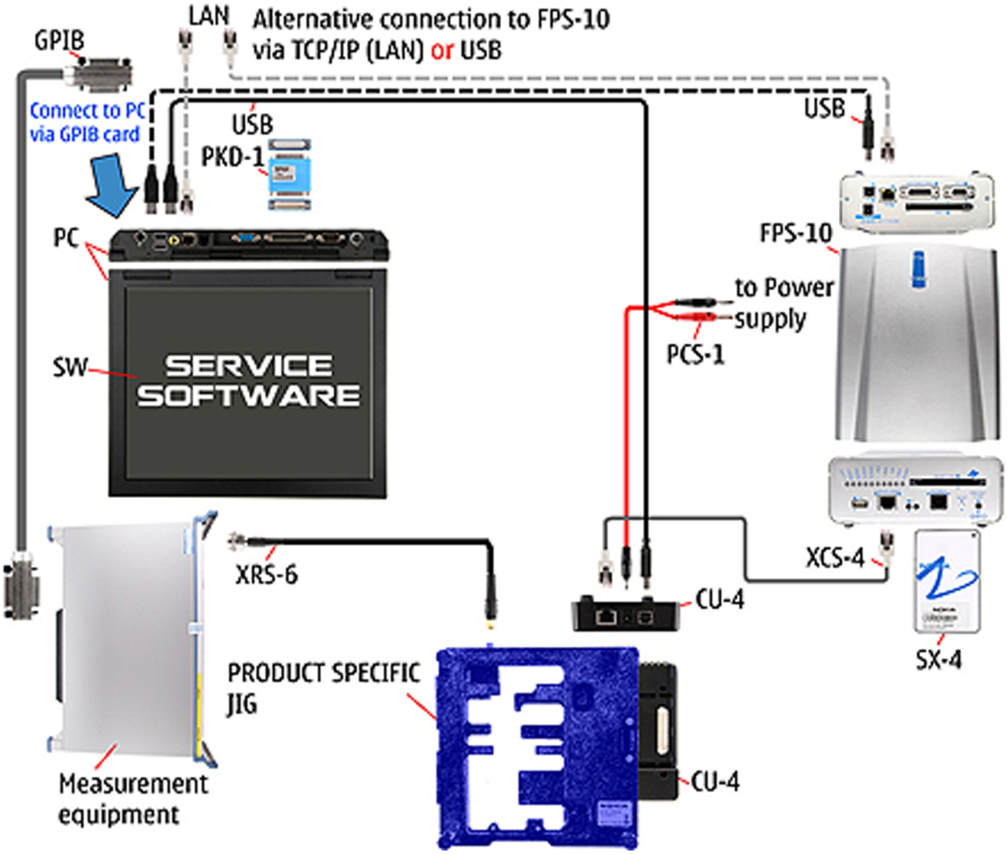

LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
GPIB
Connect to PC
via GPIB card
USB
PKD-1
USB
FPS-10
PC
to Power
supply
PCS-1
SW
SERVICE
SOFTWARE
XRS-6
XCS-4
CU-4
SX-4
PRODUCT SPECIFIC
JIG
CU-4
Measurement
equipment

Figure 5 Module jig service concept

Type	Description
Phone specific devices	
MJ-116	Module jig
Other devices	
CU-4	Control unit
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SX-4	Smart card
	PC with VPOS and Phoenix service software
	Measurement equipment
Cables	
PCS-1	DC power cable
XCS-4	Modular cable
XRF-1	RF cable
	USB cable

Type	Description
	GPIB control cable

Module jig MJ-136 set up

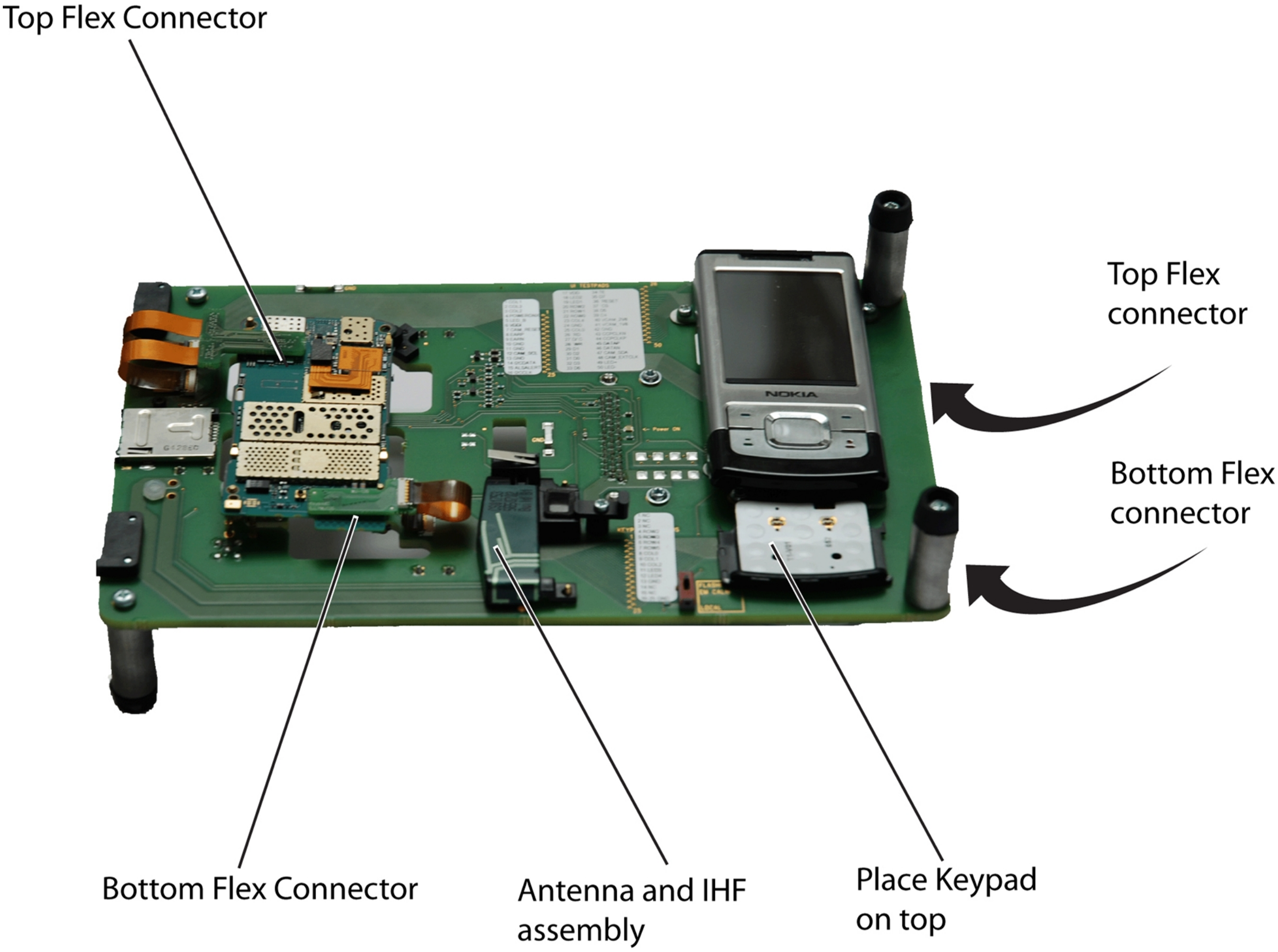

Top Flex Connector
Top Flex connector
Bottom Flex connector
Bottom Flex Connector
Antenna and IHF assembly
Place Keypad on top

Figure 6 Module jig MJ-136 set up (PWB for RM-240 us used)

1 Remove the PWB, antenna IHF assembly, bottom keymat assembly and bottom flex from the phone.
2 Fit the PWB according to illustration above and connect the top flex connector.
3 Fit the antenna IHF assembly and lock it.
4 Close the supporting frame of the jig over the PWB.
5 Pass the bottom flex connector through the lid in the jig and connect it on the backside of the jig.
6 Fit the bottom flex to the jig by using 2 screws and place the bottom keymat on top.
7 Pass the top flex connector through the jig and connect it on the back side.
8 Put the phone upper part in place on the jig.

RF testing concept with RF coupler

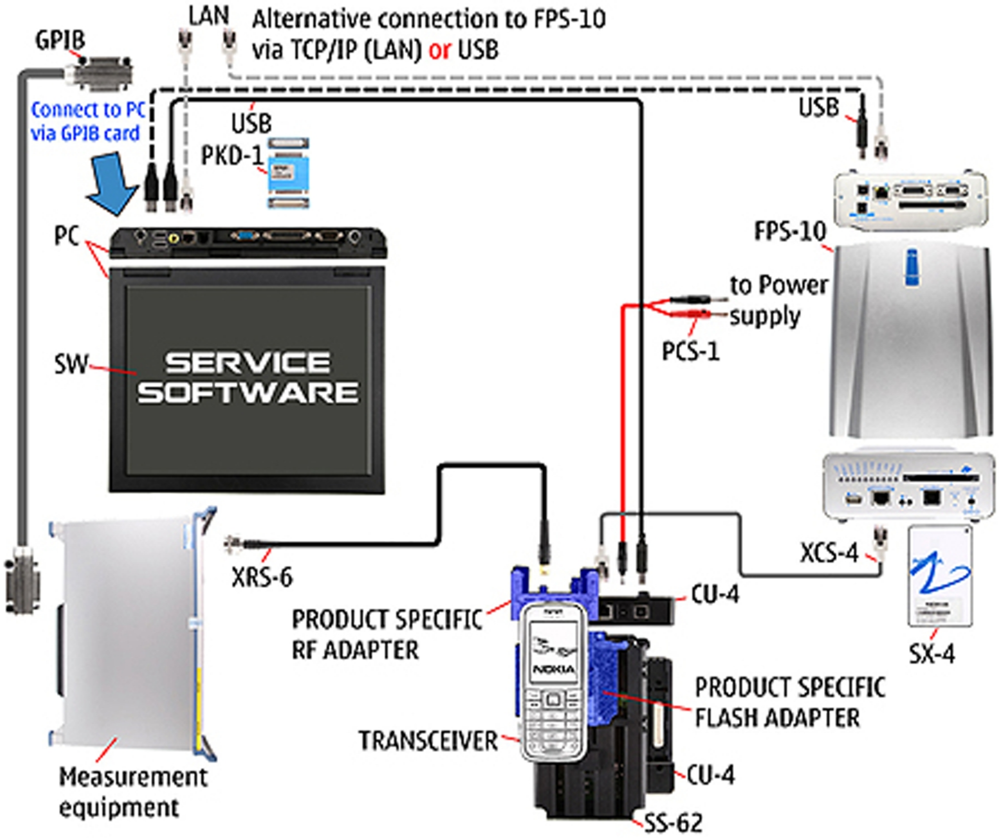

GPIB
LAN
Alternative connection to FPS-10
via TCP/IP (LAN) or USB
Connect to PC via GPIB card
USB
PKD-1
USB
PC
FPS-10
to Power supply
PCS-1
SW
SERVICE SOFTWARE
XRS-6
XCS-4
CU-4
PRODUCT SPECIFIC RF ADAPTER
SX-4
PRODUCT SPECIFIC FLASH ADAPTER
TRANSCEIVER
CU-4
Measurement equipment
SS-62

Figure 7 RF testing concept with RF coupler

Type	Description
Product specific devices	
FS-53	Flash adapter
SA-101	RF coupler
Other devices	
CU-4	Control unit
SX-4	Smart card
FPS-10	Flash prommer box
PKD-1/PK-1	SW security device
SS-62	Flash adapter base
	Measurement equipment
	PC with Phoenix service software
Cables	
PCS-1	Power cable
XCS-4	Modular cable
XRS-6	RF cable

Type	Description
	GPIB control cable
	USB cable

Service concept for RF testing and RF/BB tuning

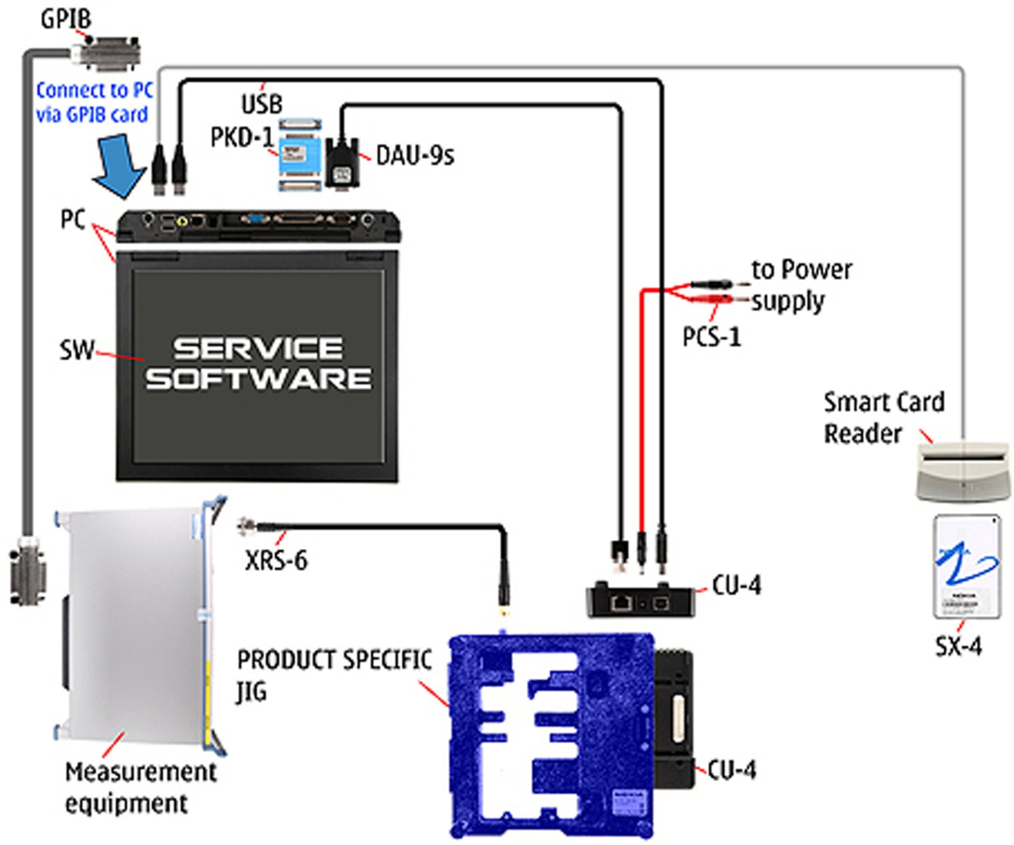

GPIB
Connect to PC via GPIB card
USB
PKD-1
DAU-9s
PC
SW
SERVICE SOFTWARE
to Power supply
PCS-1
Smart Card Reader
XRS-6
CU-4
SX-4
PRODUCT SPECIFIC JIG
CU-4
Measurement equipment

Figure 8 Service concept for RF testing and RF/BB tuning

Type	Description
Product specific devices	
MJ-116	Module jig
Other devices	
CU-4	Control unit
PKD-1/PK-1	SW security device
SX-4	Smart card
	Measurement equipment
	Smart card reader
	PC with Phoenix service software
Cables	
DAU-9s	MBUS cable

Type	Description
PCS-1	DC power cable
XRS-6	RF cable
	GPIB control cable
	USB cable

3 — BB Troubleshooting and Manual Tuning Guide

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Figure 12 Differential output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected. 3–36
Figure 13 Single-ended output waveform of the HP_in_Ext_out loop when microphone is connected. ... 3–37

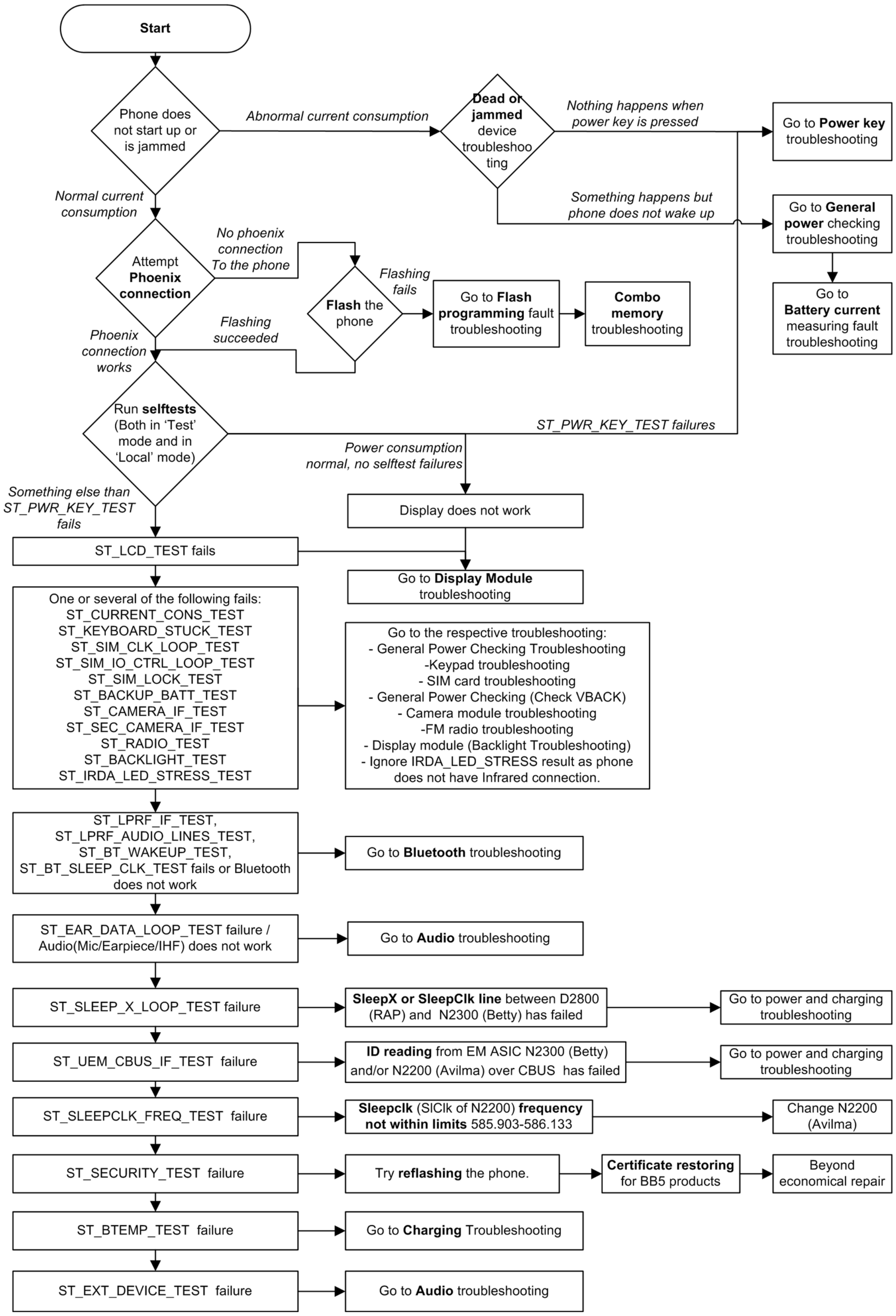
Baseband self tests in Phoenix

Context

Always start the troubleshooting procedure by running the Phoenix self tests. If a test fails, please follow the diagram below.

If the phone is dead and you cannot perform the self tests, go to *Dead or jammed device troubleshooting.*

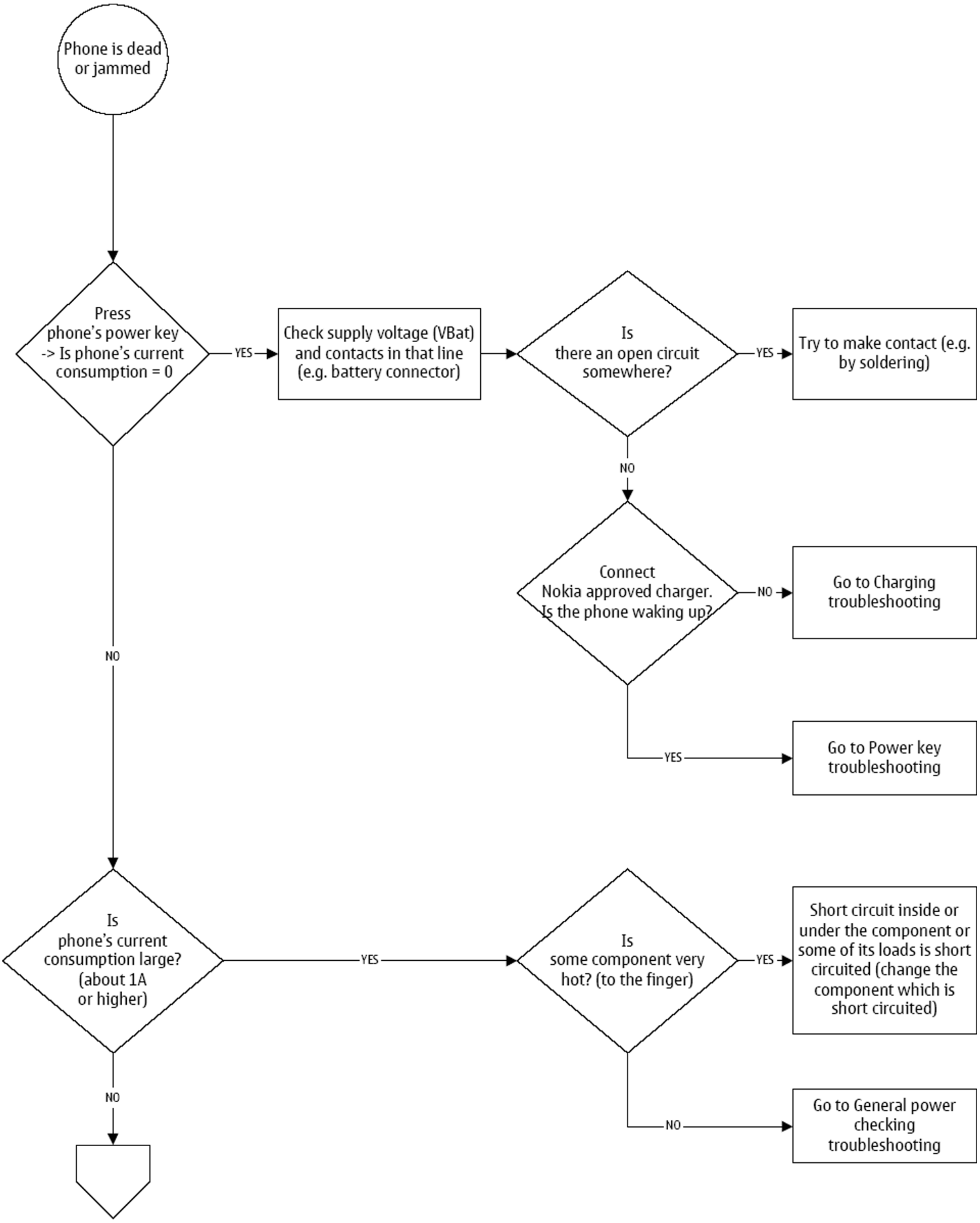
Troubleshooting flow


Start
Phone does not start up or is jammed
Abnormal current consumption
Dead or jammed device troubleshooting
Nothing happens when power key is pressed
Go to Power key troubleshooting
Something happens but phone does not wake up
Go to General power checking troubleshooting
Go to Battery current measuring fault troubleshooting
Normal current consumption
Attempt Phoenix connection
No phoenix connection To the phone
Flash the phone
Flashing fails
Go to Flash programming fault troubleshooting
Combo memory troubleshooting
Flashing succeeded
Phoenix connection works
Run selftests (Both in 'Test' mode and in 'Local' mode)
ST_PWR_KEY_TEST failures
Power consumption normal, no selftest failures
Display does not work
Something else than ST_PWR_KEY_TEST fails
ST_LCD_TEST fails
Go to Display Module troubleshooting
One or several of the following fails: ST_CURRENT_CONS_TEST ST_KEYBOARD_STUCK_TEST ST_SIM_CLK_LOOP_TEST ST_SIM_IO_CTRL_LOOP_TEST ST_SIM_LOCK_TEST ST_BACKUP_BATT_TEST ST_CAMERA_IF_TEST ST_SEC_CAMERA_IF_TEST ST_RADIO_TEST ST_BACKLIGHT_TEST ST_IRDA_LED_STRESS_TEST
Go to the respective troubleshooting: - General Power Checking Troubleshooting -Keypad troubleshooting - SIM card troubleshooting - General Power Checking (Check VBACK) - Camera module troubleshooting -FM radio troubleshooting - Display module (Backlight Troubleshooting) - Ignore IRDA_LED_STRESS result as phone does not have Infrared connection.
ST_LPRF_IF_TEST, ST_LPRF_AUDIO_LINES_TEST, ST_BT_WAKEUP_TEST, ST_BT_SLEEP_CLK_TEST fails or Bluetooth does not work
Go to Bluetooth troubleshooting
ST_EAR_DATA_LOOP_TEST failure / Audio(Mic/Earpiece/IHF) does not work
Go to Audio troubleshooting
ST_SLEEP_X_LOOP_TEST failure
SleepX or SleepClk line between D2800 (RAP) and N2300 (Betty) has failed
Go to power and charging troubleshooting
ST_UEM_CBUS_IF_TEST failure
ID reading from EM ASIC N2300 (Betty) and/or N2200 (Avilma) over CBUS has failed
Go to power and charging troubleshooting
ST_SLEEPCLK_FREQ_TEST failure
Sleepclk (SlClk of N2200) frequency not within limits 585.903-586.133
Change N2200 (Avilma)
ST_SECURITY_TEST failure
Try reflashing the phone.
Certificate restoring for BB5 products
Beyond economical repair
ST_BTEMP_TEST failure
Go to Charging Troubleshooting
ST_EXT_DEVICE_TEST failure
Go to Audio troubleshooting

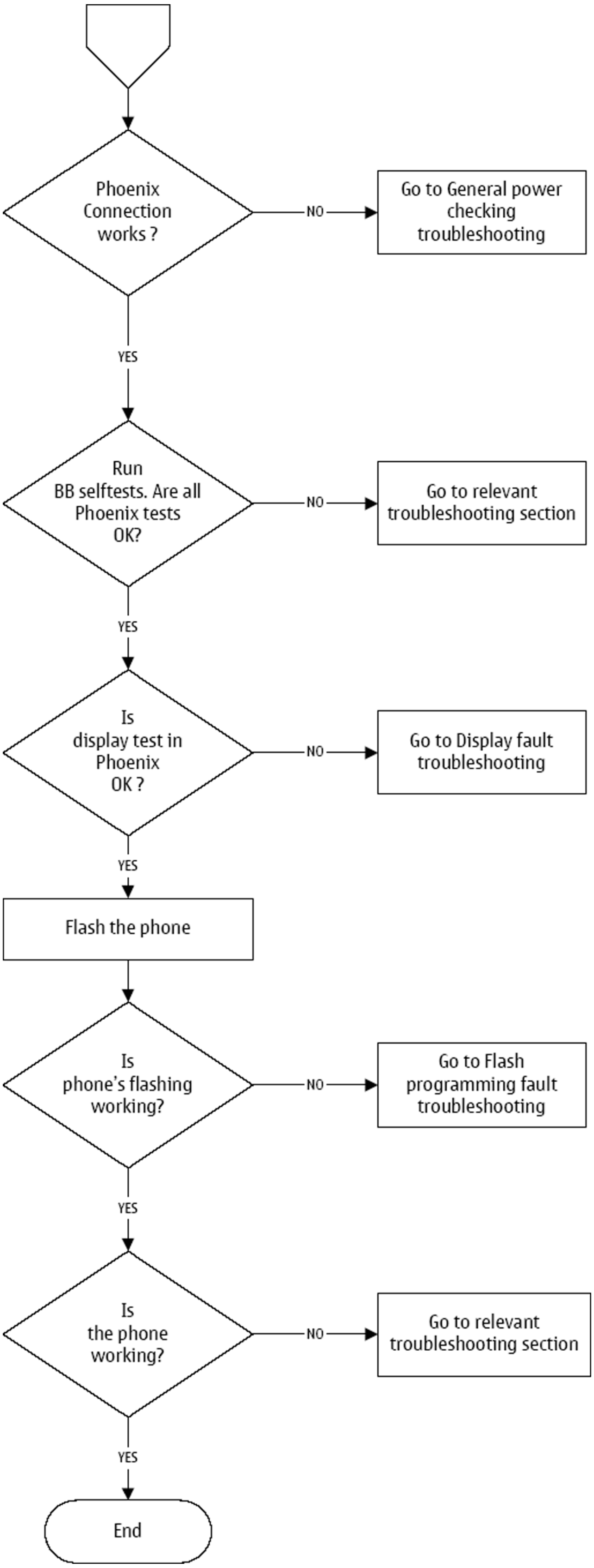
Power and charging troubleshooting

Dead or jammed device troubleshooting

Troubleshooting flow


Phone is dead or jammed
Press phone's power key -> Is phone's current consumption = 0
YES
Check supply voltage (VBat) and contacts in that line (e.g. battery connector)
Is there an open circuit somewhere?
YES
Try to make contact (e.g. by soldering)
NO
Connect Nokia approved charger. Is the phone waking up?
NO
Go to Charging troubleshooting
YES
Go to Power key troubleshooting
NO
Is phone's current consumption large? (about 1A or higher)
YES
Is some component very hot? (to the finger)
YES
Short circuit inside or under the component or some of its loads is short circuited (change the component which is short circuited)
NO
Go to General power checking troubleshooting
NO

Troubleshooting flow


Phoenix Connection works ?
NO
Go to General power checking troubleshooting
YES
Run BB selftests. Are all Phoenix tests OK?
NO
Go to relevant troubleshooting section
YES
Is display test in Phoenix OK ?
NO
Go to Display fault troubleshooting
YES
Flash the phone
Is phone's flashing working?
NO
Go to Flash programming fault troubleshooting
YES
Is the phone working?
NO
Go to relevant troubleshooting section
YES
End

General power checking

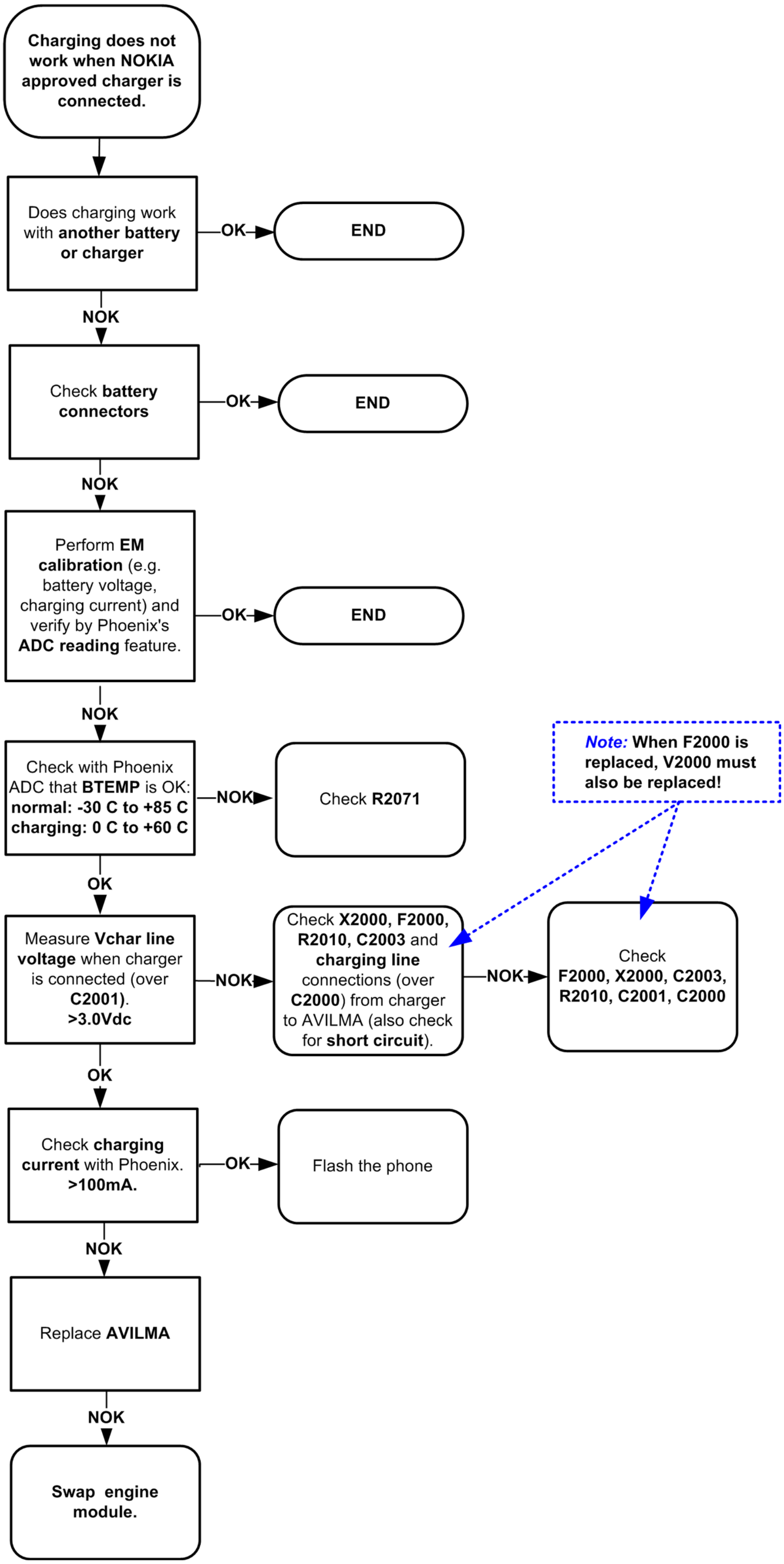
Check the following voltages:

Signal name	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes
VIO	AVILMA	ON	ON	1.82	Memory, I/Os, Display	
VBACK	AVILMA	ON	ON	2.5	Back-up battery	
VSIM1	AVILMA	ON	ON	1.8/3.0	SIM card	
VDRAM	AVILMA	ON	ON	1.82	SDRAM	
VAUX	AVILMA	OFF	OFF	2.5	Hall sensor display	
VANA	AVILMA	ON	ON	2.5	Audio, some pull-ups	
VR1	AVILMA	OFF	ON	2.5	Crystal oscillators	
VRFC	AVILMA	OFF	ON	1.8	RAP converters	
VRCP1	AVILMA			4.75	To RF parts	RF active
VREF	AVILMA	ON	ON	1.35	RF reference	
VCORE	BETTY	ON	ON	1.05 1.25 1.35 1.40	RAP digital	
VOUT	BETTY	OFF	OFF	2.5	Analogue switch	Accessory connected
VCAM_2V8	LP3987ITLX-2.85/N3300	OFF	OFF	2.850	Camera	Disabled in sleep
VCAM_1V8	LM3677TLX-1.82/L3300	OFF	OFF	1.800	Camera	Disabled in sleep
VCAM_1V3	LP5952TLX-1.3/L3403	OFF	OFF	1.3	Camera	Disabled in sleep
VSD	LP3928TLX-1828/Z4800	OFF	OFF	2.850	MMC/SD card	Disabled in sleep
VLEDOUT	TPS61061/ N2301	OFF	OFF	14.5	LCD Backlight	Disabled in sleep
VDAC	LP3985-3/ N2006	OFF	OFF	3.0	DAC-33	Disabled in sleep
VLED	TPS75105/ N2401	OFF	OFF	4.0	Keyboard backlight	Disabled in sleep

Signal name	Regulator	Sleep	Idle	Nominal voltage	Main user	Notes
VRGB	LP5521/ N2440	OFF	OFF	4.0	Keyboard backlight	Disabled in sleep

Charging troubleshooting

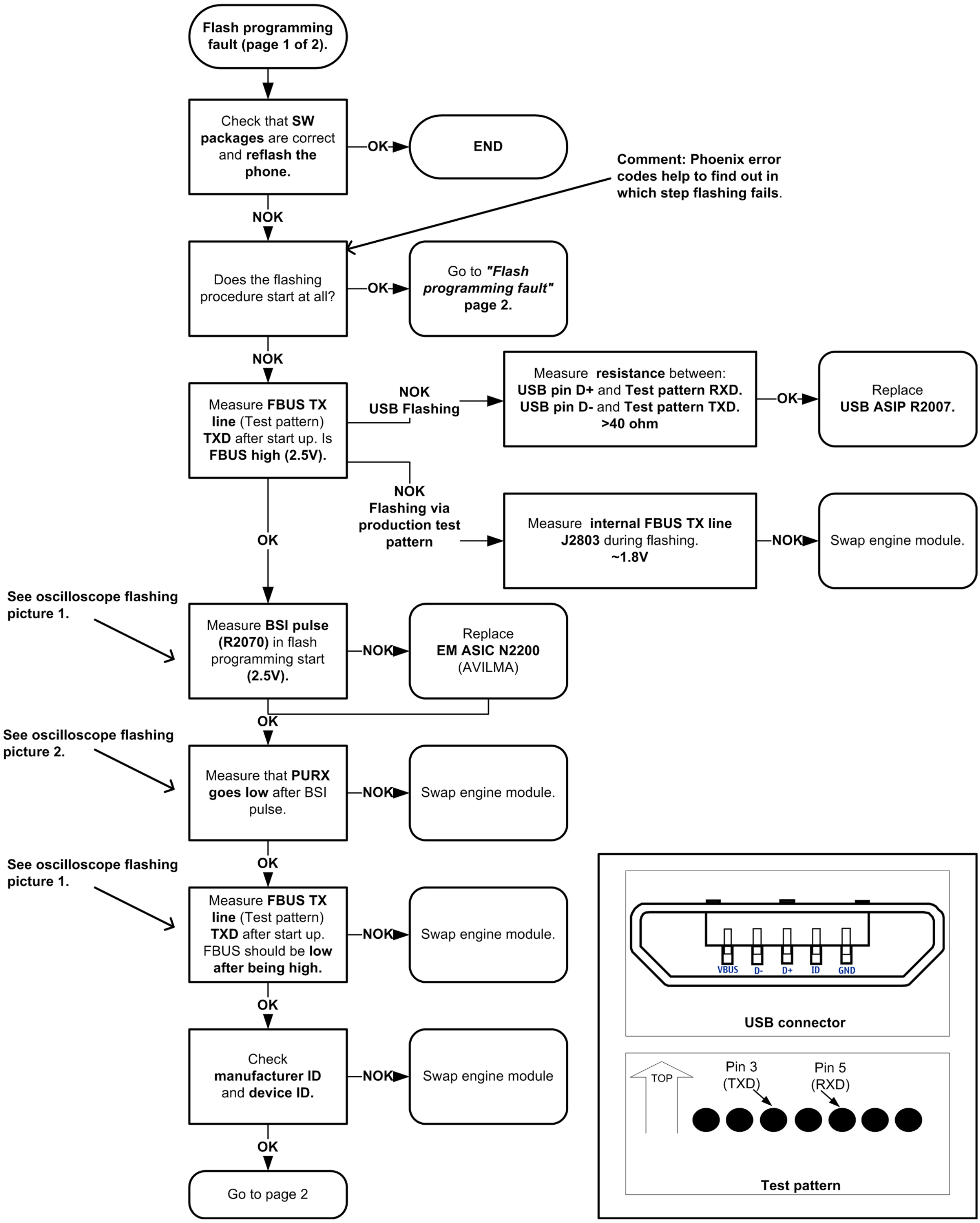
Troubleshooting flow


Charging does not work when NOKIA approved charger is connected.
Does charging work with another battery or charger
OK
END
NOK
Check battery connectors
OK
END
NOK
Perform EM calibration (e.g. battery voltage, charging current) and verify by Phoenix's ADC reading feature.
OK
END
NOK
Check with Phoenix ADC that BTEMP is OK: normal: -30 C to +85 C charging: 0 C to +60 C
NOK
Check R2071
Note: When F2000 is replaced, V2000 must also be replaced!
OK
Measure Vchar line voltage when charger is connected (over C2001). >3.0Vdc
NOK
Check X2000, F2000, R2010, C2003 and charging line connections (over C2000) from charger to AVILMA (also check for short circuit).
NOK
Check F2000, X2000, C2003, R2010, C2001, C2000
OK
Check charging current with Phoenix. >100mA.
OK
Flash the phone
NOK
Replace AVILMA
NOK
Swap engine module.

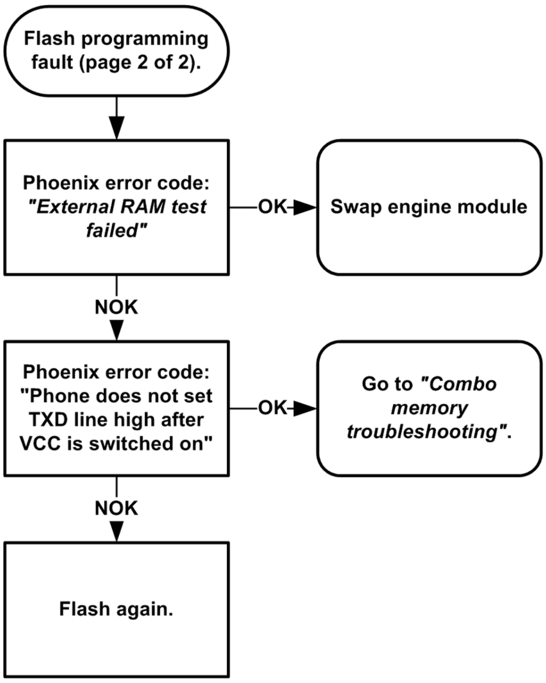
Interface troubleshooting

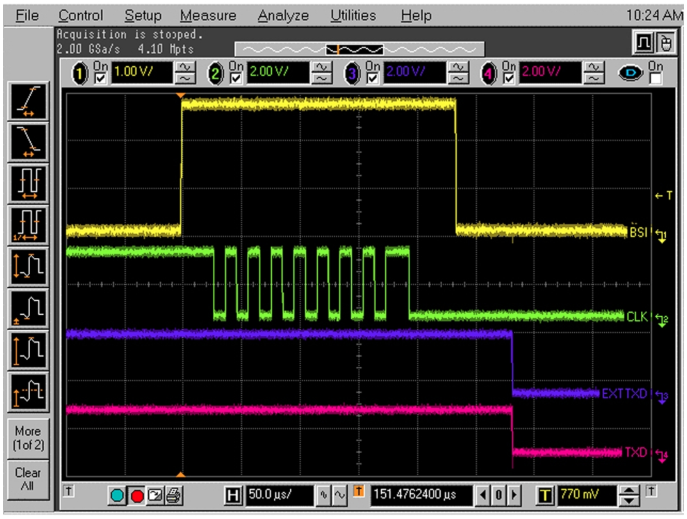
Flash programming fault troubleshooting

Part 1


Flash programming fault (page 1 of 2).
Check that SW packages are correct and reflash the phone.
OK
END
Comment: Phoenix error codes help to find out in which step flashing fails.
NOK
Does the flashing procedure start at all?
OK
Go to "Flash programming fault" page 2.
NOK
Measure FBUS TX line (Test pattern) TXD after start up. Is FBUS high (2.5V).
NOK
USB Flashing
Measure resistance between: USB pin D+ and Test pattern RXD. USB pin D- and Test pattern TXD. >40 ohm
OK
Replace USB ASIP R2007.
NOK
Flashing via production test pattern
Measure internal FBUS TX line J2803 during flashing. ~1.8V
NOK
Swap engine module.
OK
See oscilloscope flashing picture 1.
Measure BSI pulse (R2070) in flash programming start (2.5V).
NOK
Replace EM ASIC N2200 (AVILMA)
OK
See oscilloscope flashing picture 2.
Measure that PURX goes low after BSI pulse.
NOK
Swap engine module.
OK
See oscilloscope flashing picture 1.
Measure FBUS TX line (Test pattern) TXD after start up. FBUS should be low after being high.
NOK
Swap engine module.
OK
Check manufacturer ID and device ID.
NOK
Swap engine module
OK
Go to page 2
VBUS
D-
D+
ID
GND
USB connector
TOP
Pin 3 (TXD)
Pin 5 (RXD)
Test pattern

Part 2


Flash programming fault (page 2 of 2).
Phoenix error code: *"External RAM test failed"*
OK
Swap engine module
NOK
Phoenix error code: "Phone does not set TXD line high after VCC is switched on"
OK
Go to *"Combo memory troubleshooting"*.
NOK
Flash again.


File
Control
Setup
Measure
Analyze
Utilities
Help
10:24 AM
On 1.00 V/
On 2.00 V/
On 2.00 V/
On 2.00 V/
On
T
BSI
CLK
EXTTXD
TXD
More (1of 2)
Clear All
H 50.0 µs/
151.4762400 µs
0
T 770 mV

Acquisition is stopped.
2.00 GSa/s 4.10 Mpts

Figure 9 Flashing pic 1. Take single trig measurement for the rise of the BSI signal.

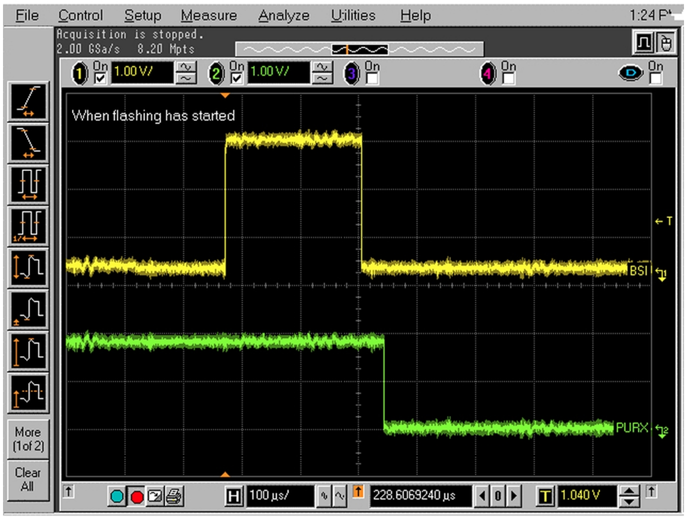
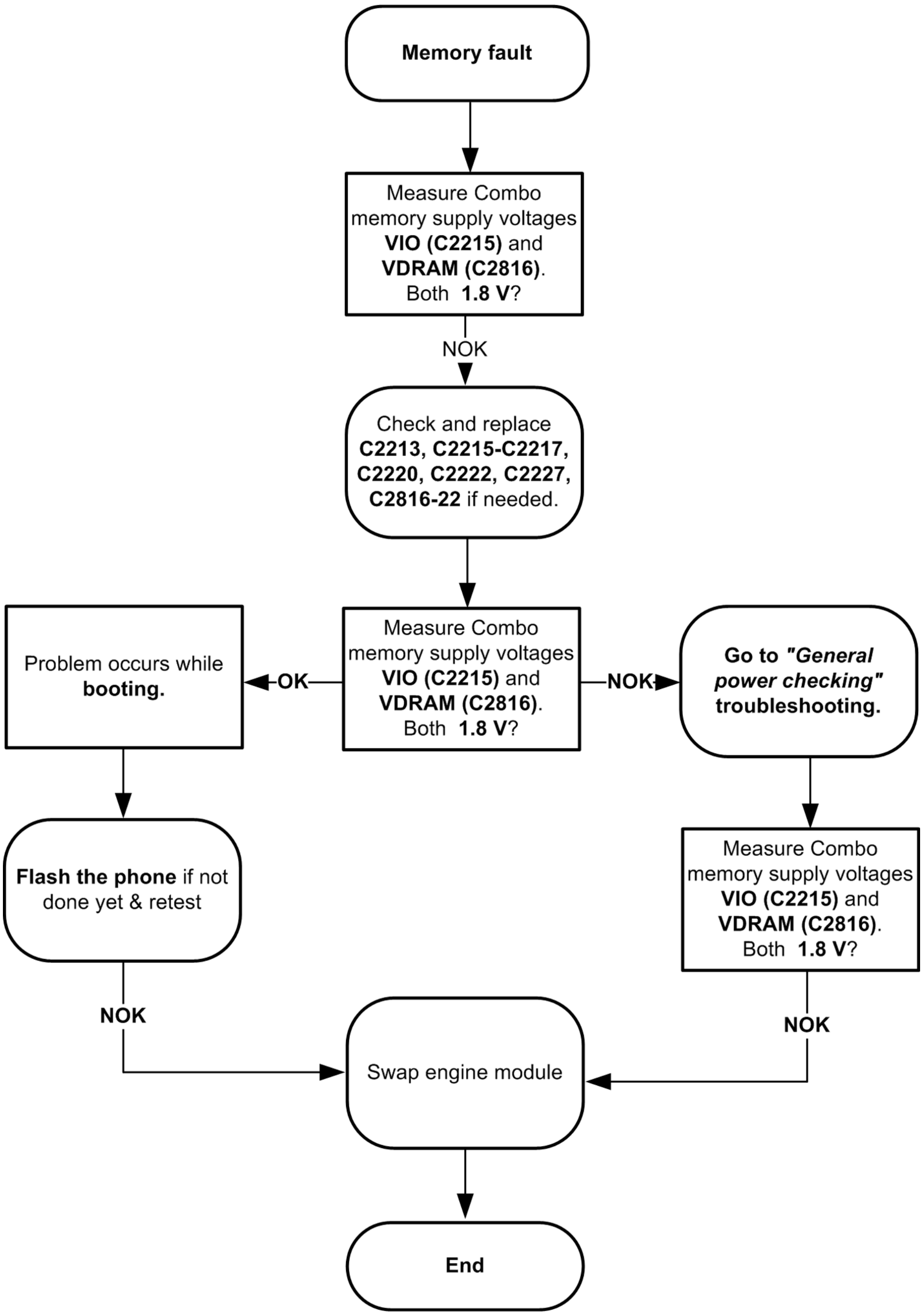

File
Control
Setup
Measure
Analyze
Utilities
Help
1:24 P
Acquisition is stopped.
2.00 GSa/s 8.20 Mpts
1.00 V/
1.00 V/
On
When flashing has started
BSI
PURX
T
More (1of 2)
Clear All
100 µs/
228.6069240 µs
1.040 V

Figure 10 Flashing pic 2. Take single trig measurement for the rise of the BSI signal.

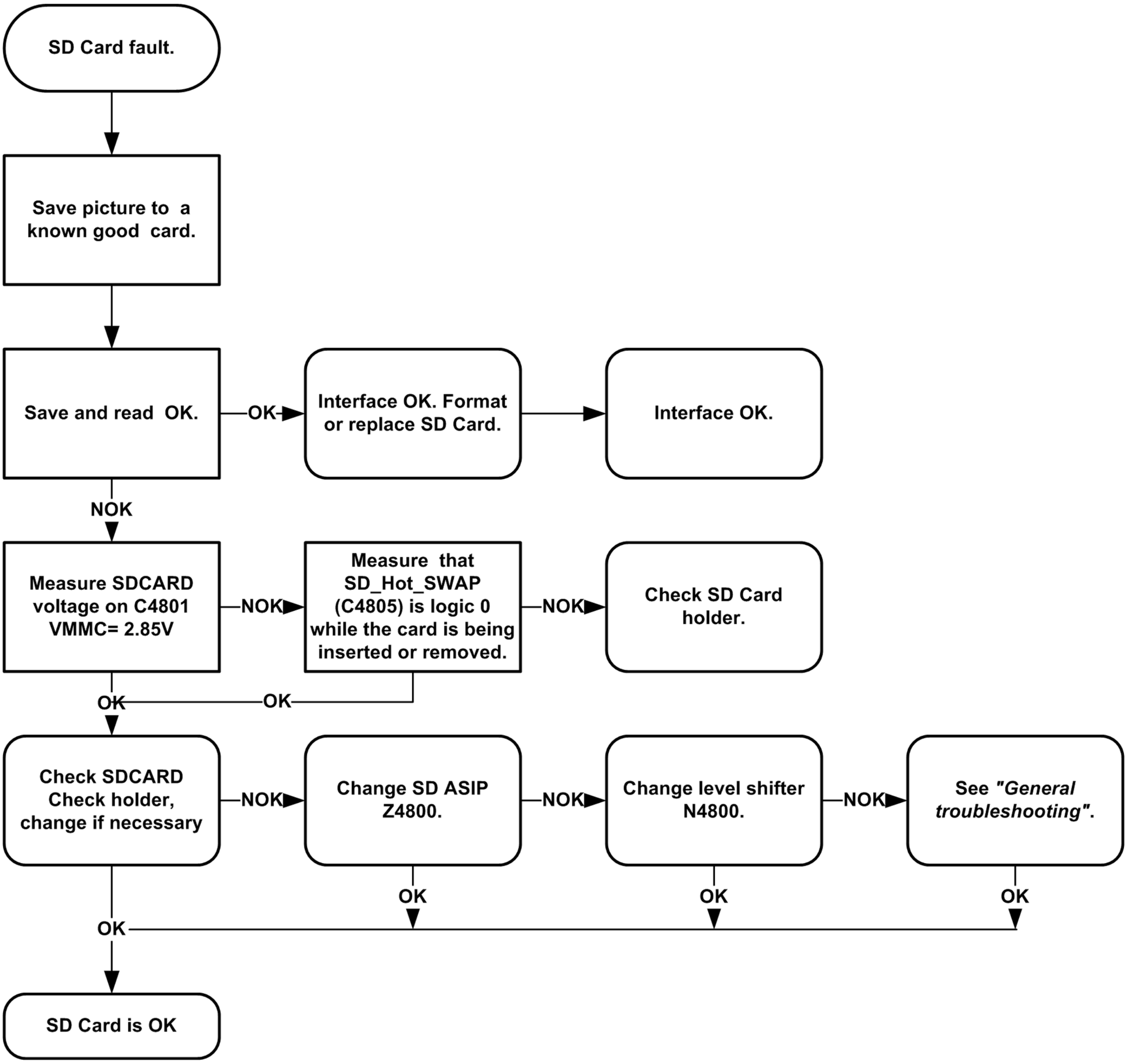
Combo memory troubleshooting

Troubleshooting flow


Memory fault
Measure Combo memory supply voltages VIO (C2215) and VDRAM (C2816). Both 1.8 V?
NOK
Check and replace C2213, C2215-C2217, C2220, C2222, C2227, C2816-22 if needed.
Measure Combo memory supply voltages VIO (C2215) and VDRAM (C2816). Both 1.8 V?
OK
Problem occurs while booting.
NOK
Go to "General power checking" troubleshooting.
Flash the phone if not done yet & retest
Measure Combo memory supply voltages VIO (C2215) and VDRAM (C2816). Both 1.8 V?
NOK
NOK
Swap engine module
End

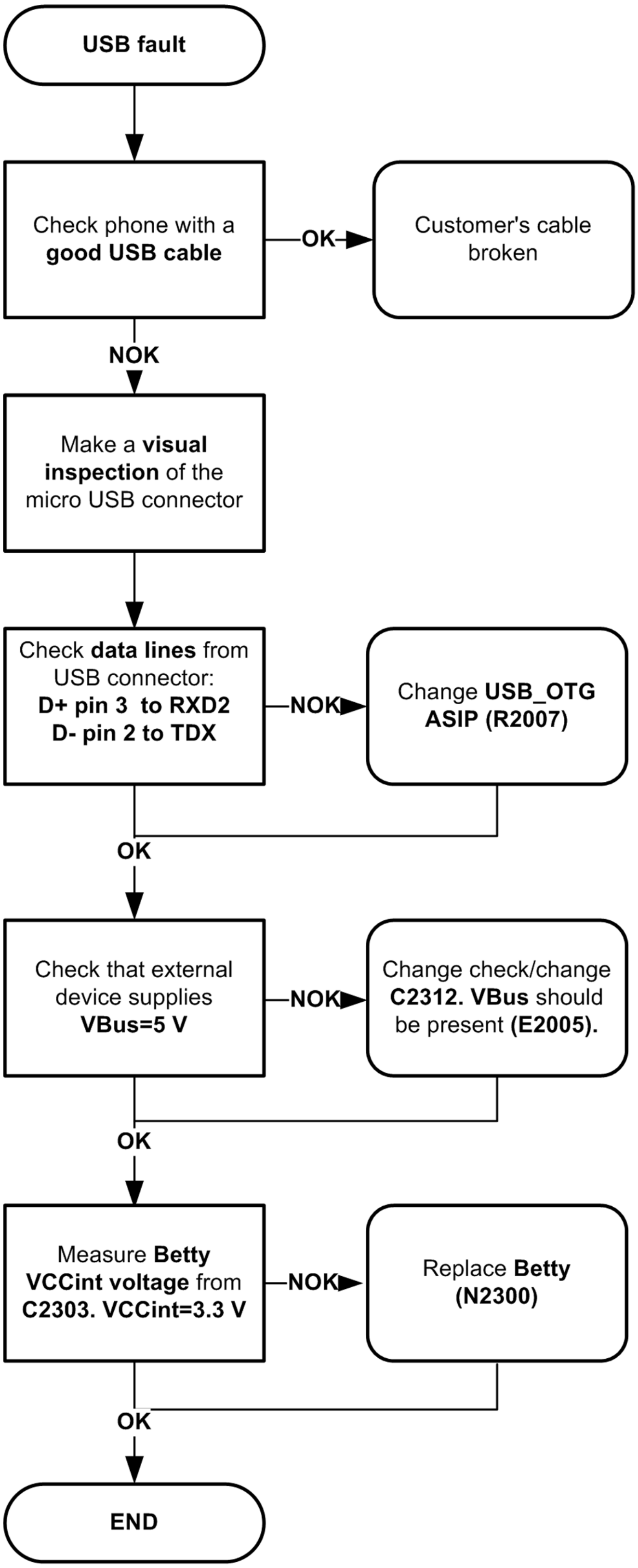
SD card troubleshooting

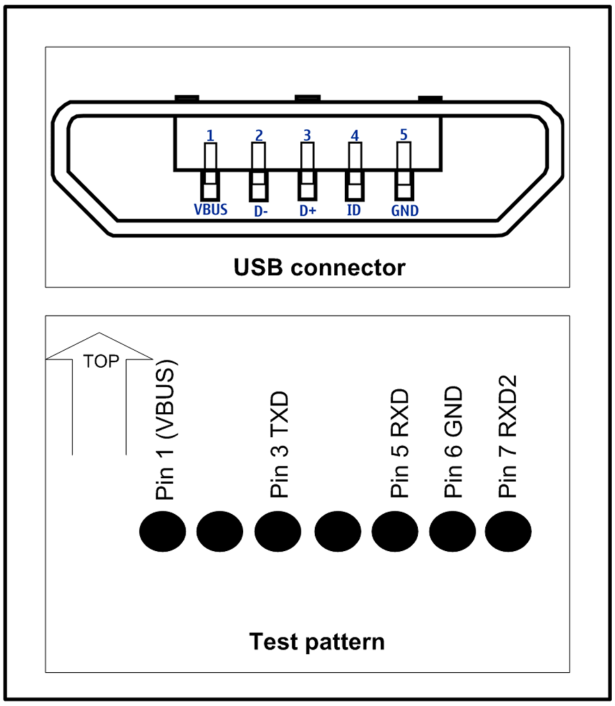
Troubleshooting flow


SD Card fault.
Save picture to a known good card.
Save and read OK.
OK
Interface OK. Format or replace SD Card.
Interface OK.
NOK
Measure SDCARD voltage on C4801 VMMC= 2.85V
NOK
Measure that SD_Hot_SWAP (C4805) is logic 0 while the card is being inserted or removed.
NOK
Check SD Card holder.
OK
OK
Check SDCARD Check holder, change if necessary
NOK
Change SD ASIP Z4800.
NOK
Change level shifter N4800.
NOK
See *"General troubleshooting"*.
OK
OK
OK
OK
SD Card is OK

USB interface troubleshooting

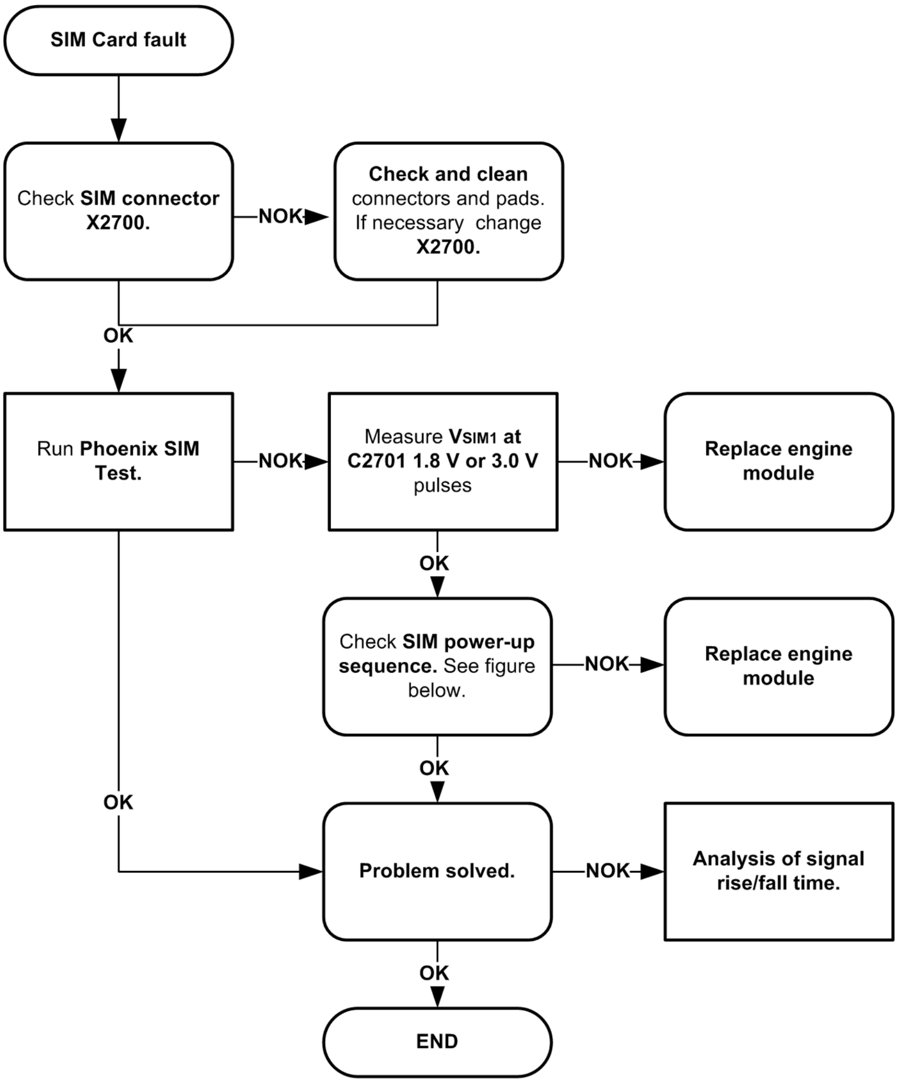
Troubleshooting flow

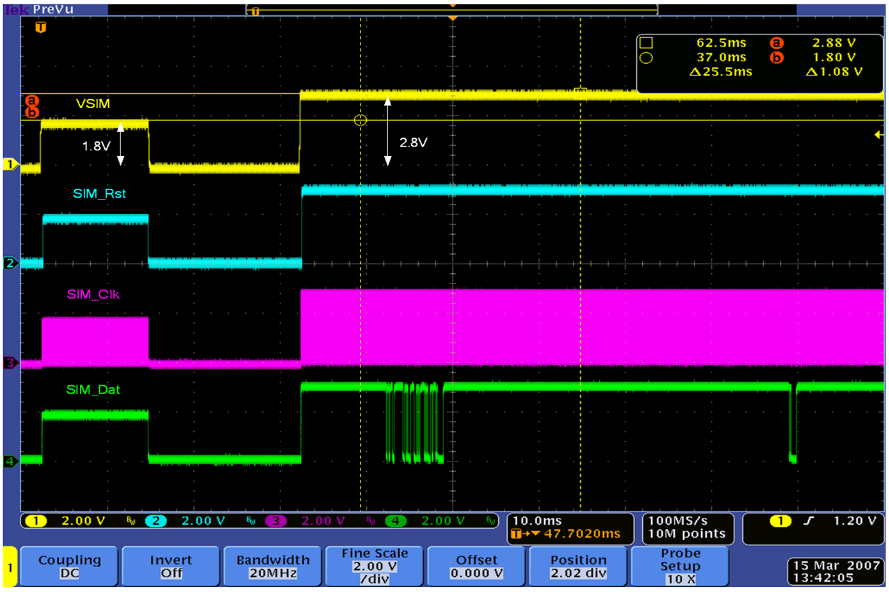

USB fault
Check phone with a good USB cable
OK
Customer's cable broken
NOK
Make a visual inspection of the micro USB connector
Check data lines from USB connector: D+ pin 3 to RXD2 D- pin 2 to TDX
NOK
Change USB_OTG ASIP (R2007)
OK
Check that external device supplies VBus=5 V
NOK
Change check/change C2312. VBus should be present (E2005).
OK
Measure Betty VCCint voltage from C2303. VCCint=3.3 V
NOK
Replace Betty (N2300)
OK
END


1
2
3
4
5
VBUS
D-
D+
ID
GND
USB connector
TOP
Pin 1 (VBUS)
Pin 3 TXD
Pin 5 RXD
Pin 6 GND
Pin 7 RXD2
Test pattern

SIM card troubleshooting

Troubleshooting flow


SIM Card fault
Check SIM connector X2700.
NOK
Check and clean connectors and pads. If necessary change X2700.
OK
Run Phoenix SIM Test.
NOK
Measure VSIM1 at C2701 1.8 V or 3.0 V pulses
NOK
Replace engine module
OK
Check SIM power-up sequence. See figure below.
NOK
Replace engine module
OK
OK
Problem solved.
NOK
Analysis of signal rise/fall time.
OK
END


Tek PreVu
62.5ms
37.0ms
Δ25.5ms
2.88 V
1.80 V
Δ1.08 V
VSIM
1.8V
2.8V
SIM_Rst
SIM_Clk
SIM_Dat
1 2.00 V
2 2.00 V
3 2.00 V
4 2.00 V
10.0ms
47.7020ms
100MS/s
10M points
1 1.20 V
Coupling DC
Invert Off
Bandwidth 20MHz
Fine Scale 2.00 V /div
Offset 0.000 V
Position 2.02 div
Probe Setup 10 X
15 Mar 2007
13:42:05

User interface troubleshooting

Keypad and side keys troubleshooting

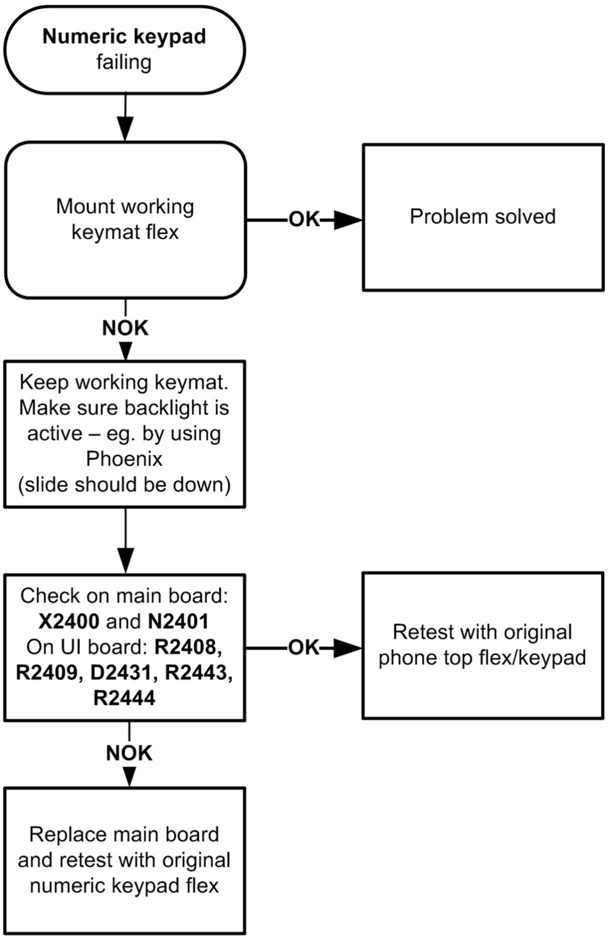
Context

There are two possible failure modes in the keyboard module:

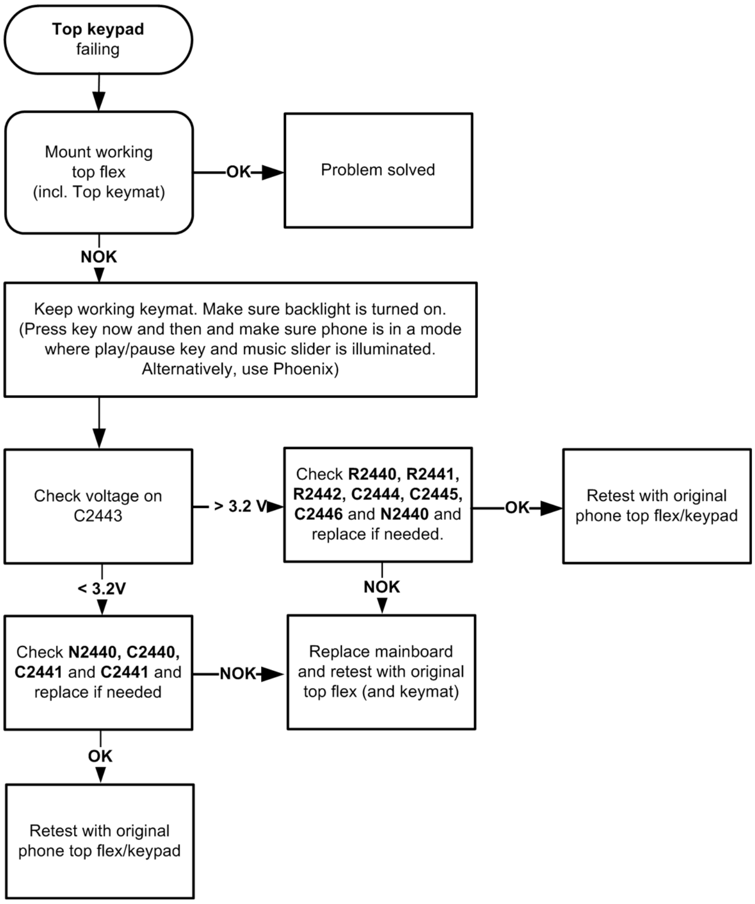
- One or more keys are stuck, so that the key does not react when a keydome or a side key is pressed. This kind of failure is caused by mechanical reasons (dirt, rust, mechanical damage, etc.)
- Malfunction of several keys at the same time; this happens when one or more rows or columns in the key matrix are failing (shortcut or open connection).

If the failure mode is not clear, start with the Keyboard test in Phoenix.

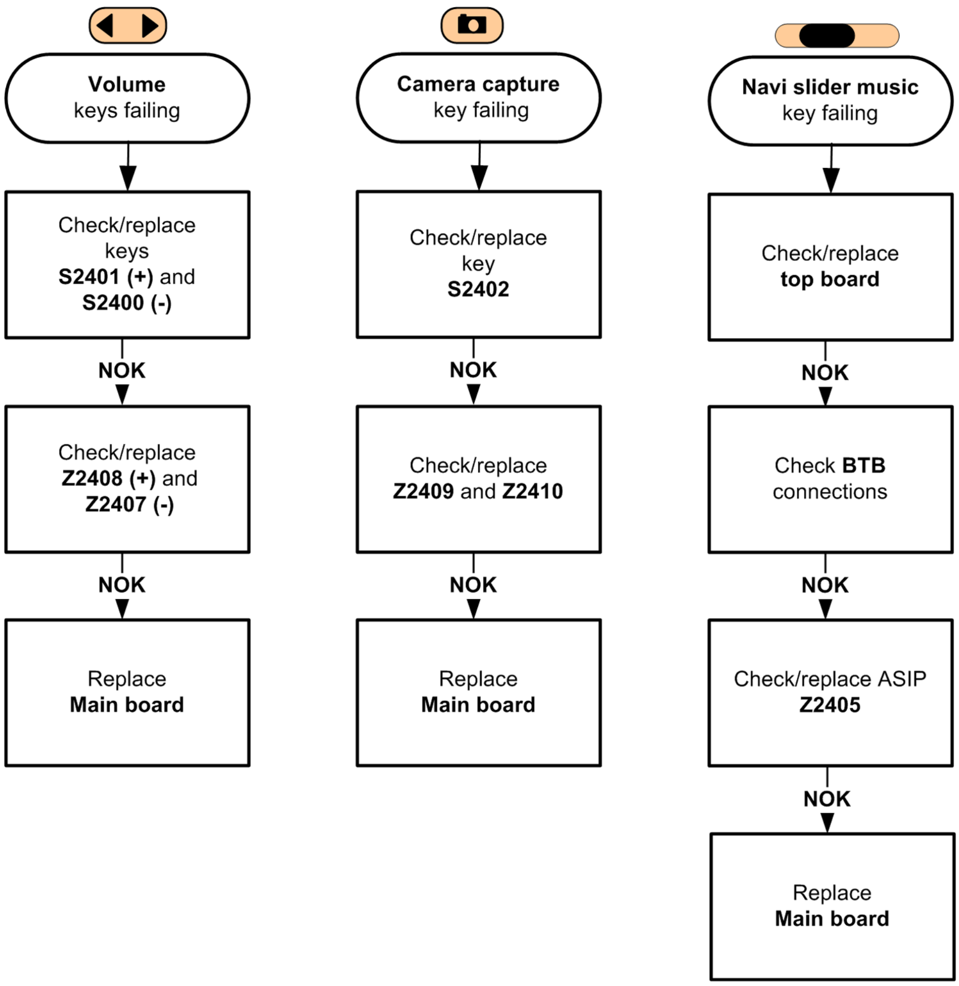
Numeric keypad troubleshooting


Numeric keypad failing
Mount working keymat flex
OK
Problem solved
NOK
Keep working keymat. Make sure backlight is active – eg. by using Phoenix (slide should be down)
Check on main board: X2400 and N2401 On UI board: R2408, R2409, D2431, R2443, R2444
OK
Retest with original phone top flex/keypad
NOK
Replace main board and retest with original numeric keypad flex

Top keypad troubleshooting


Top keypad failing
Mount working top flex (incl. Top keymat)
OK
Problem solved
NOK
Keep working keymat. Make sure backlight is turned on. (Press key now and then and make sure phone is in a mode where play/pause key and music slider is illuminated. Alternatively, use Phoenix)
Check voltage on C2443
> 3.2 V
Check **R2440, R2441, R2442, C2444, C2445, C2446** and **N2440** and replace if needed.
OK
Retest with original phone top flex/keypad
NOK
< 3.2V
Check **N2440, C2440, C2441** and **C2441** and replace if needed
NOK
Replace mainboard and retest with original top flex (and keymat)
OK
Retest with original phone top flex/keypad

Side keys troubleshooting


Volume keys failing
Check/replace keys S2401 (+) and S2400 (-)
NOK
Check/replace Z2408 (+) and Z2407 (-)
NOK
Replace Main board
Camera capture key failing
Check/replace key S2402
NOK
Check/replace Z2409 and Z2410
NOK
Replace Main board
Navi slider music key failing
Check/replace top board
NOK
Check BTB connections
NOK
Check/replace ASIP Z2405
NOK
Replace Main board

Display module troubleshooting

General instructions for display troubleshooting

Context

- The display is in a normal mode when the phone is in active use.
- Display is in a partial idle mode when the phone is in the screen saver mode.
- The operating modes of the display can be controlled with the help of *Phoenix*.

Table 4 Display module troubleshooting cases

Display blank	There is no image on the display. The display looks the same when the phone is on as it does when the phone is off. The backlight can be on in some cases.
Image on the display not correct	Image on the display can be corrupted or a part of the image can be missing. If a part of the image is missing, change the display module. If the image is otherwise corrupted, follow the appropriate troubleshooting diagram.

Backlight dim or not working at all	Backlight LED components are inside the display module. Backlight failure can also be in the connector or in the backlight power source in the main engine of the phone. This means that in case the display is working (image OK), the backlight is faulty.
Visual defects (pixel)	Pixel defects can be checked by controlling the display with Phoenix. Use both colours, black and white, on a full screen. The display may have some random pixel defects that are acceptable for this type of display. The criteria when pixel defects are regarded as a display failure, resulting in a replacement of the display, are presented the following table.

Table 5 Pixel defects

Item		White dot defect				Black dot defect	Total
1	Defect counts	R	G	B	White Dot Total	1	1
		1	1	1	1		
2	Combined defect counts	Not allowed. Two single dot defects that are within 5 mm of each other should be interpreted as combined dot defect.					

Steps

1. Verify with a working display that the fault is not on the display module itself.

   The display module cannot be repaired.
2. Check that the cellular engine is working normally.
   - i To check the functionality, connect the phone to a docking station.
   - ii Start *Phoenix* service software.
   - iii Read the phone information to check that also the application engine is functioning normally (you should be able to read the APE ID).
3. Proceed to the display troubleshooting flowcharts.

   Use the **Display Test** tool in *Phoenix* to find the detailed fault mode.

Display troubleshooting

Context

There are three different display fault cases;

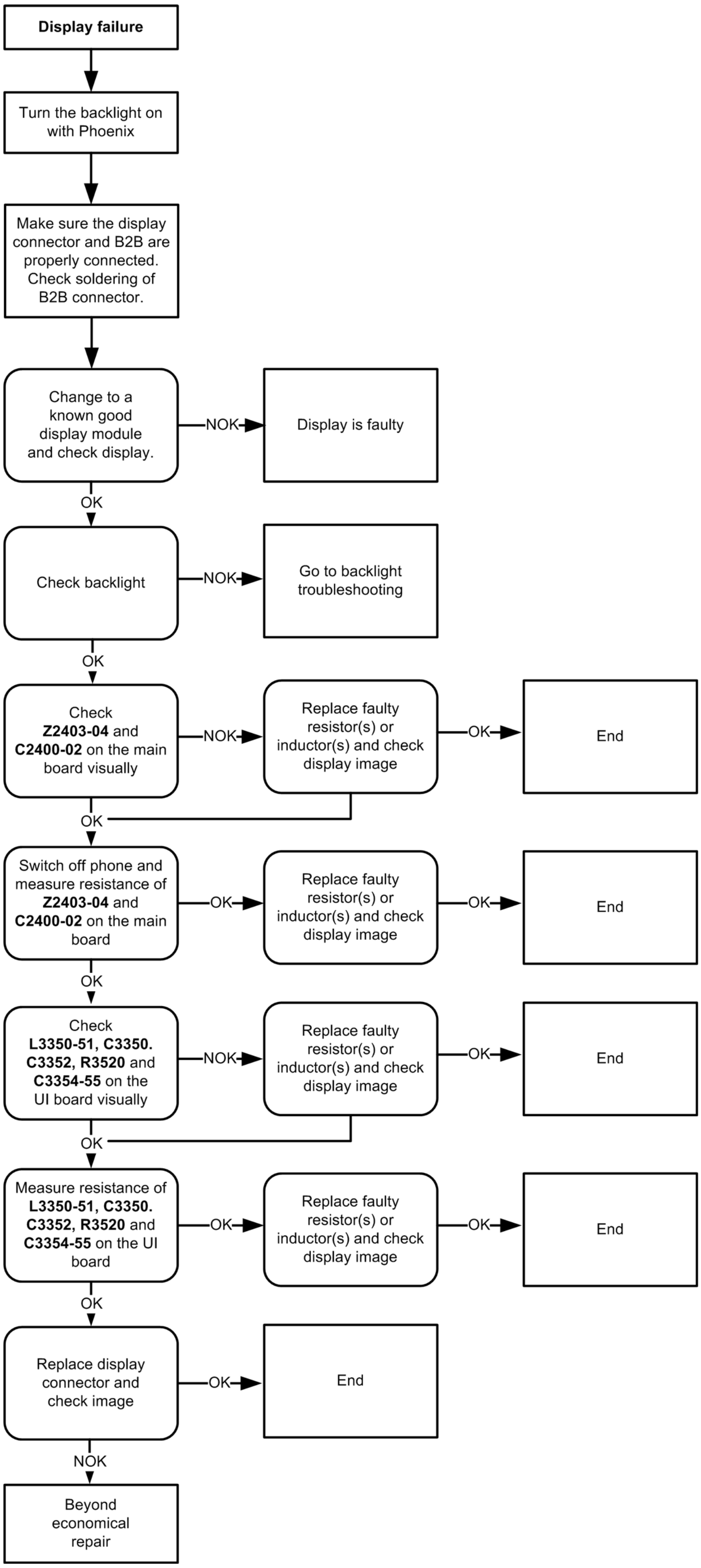
1 No backlights when image is on

2 No image when backlight is on

3 No backlight and no image

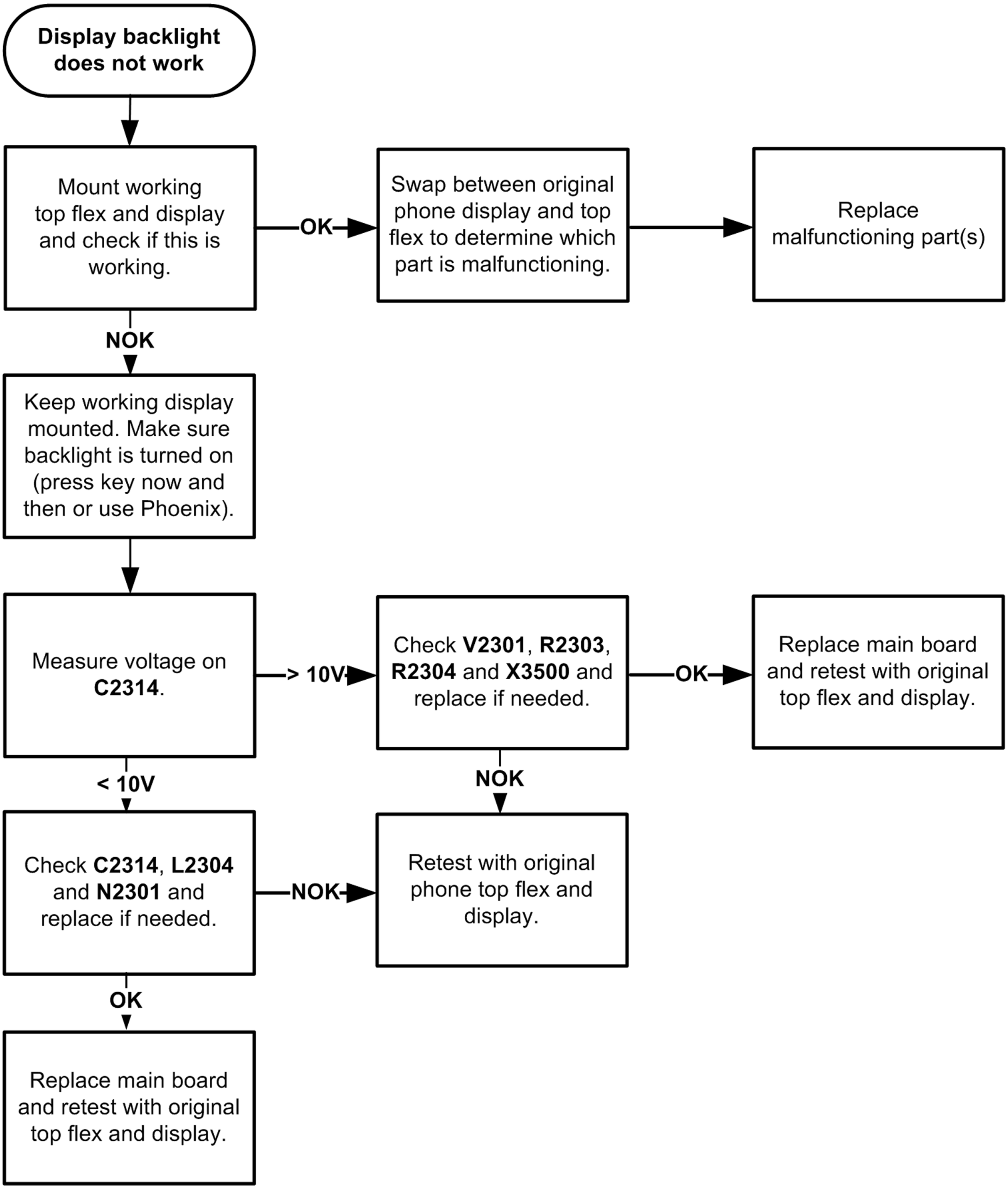
Note: When assembling/disassembling the phone, all grounding contacts between different levels (display, display flex, display frame, BTBI connector) must be checked in order to have them properly connected.

Troubleshooting flow


Display failure
Turn the backlight on with Phoenix
Make sure the display connector and B2B are properly connected. Check soldering of B2B connector.
Change to a known good display module and check display.
NOK
Display is faulty
OK
Check backlight
NOK
Go to backlight troubleshooting
OK
Check **Z2403-04** and **C2400-02** on the main board visually
NOK
Replace faulty resistor(s) or inductor(s) and check display image
OK
End
OK
Switch off phone and measure resistance of **Z2403-04** and **C2400-02** on the main board
OK
Replace faulty resistor(s) or inductor(s) and check display image
OK
End
OK
Check **L3350-51, C3350. C3352, R3520** and **C3354-55** on the UI board visually
NOK
Replace faulty resistor(s) or inductor(s) and check display image
OK
End
OK
Measure resistance of **L3350-51, C3350. C3352, R3520** and **C3354-55** on the UI board
OK
Replace faulty resistor(s) or inductor(s) and check display image
OK
End
OK
Replace display connector and check image
OK
End
NOK
Beyond economical repair

Display backlight troubleshooting

Troubleshooting flow


Display backlight does not work
Mount working top flex and display and check if this is working.
OK
Swap between original phone display and top flex to determine which part is malfunctioning.
Replace malfunctioning part(s)
NOK
Keep working display mounted. Make sure backlight is turned on (press key now and then or use Phoenix).
Measure voltage on **C2314**.
> 10V
Check **V2301**, **R2303**, **R2304** and **X3500** and replace if needed.
OK
Replace main board and retest with original top flex and display.
NOK
< 10V
Check **C2314**, **L2304** and **N2301** and replace if needed.
NOK
Retest with original phone top flex and display.
OK
Replace main board and retest with original top flex and display.

Camera module troubleshooting

Introduction to camera troubleshooting

Bad conditions often cause bad pictures. Therefore, the camera operation has to be checked in constant conditions or by using a second, known-to-be-good Nokia device as reference. Image quality is hard to measure quantitatively, and the difference between a good and a bad picture can be small. Some training or experience may be needed to detect what is actually wrong.

When checking for possible errors in camera functionality, knowing what error is suspected significantly helps the testing by narrowing down the amount of test cases. The following types of image quality problems are common:

- Dust (black spots)
- Lack of sharpness
- Bit errors

Back (main) camera troubleshooting

Taking and evaluating test pictures with main camera

When *taking* a test picture, remember the following:

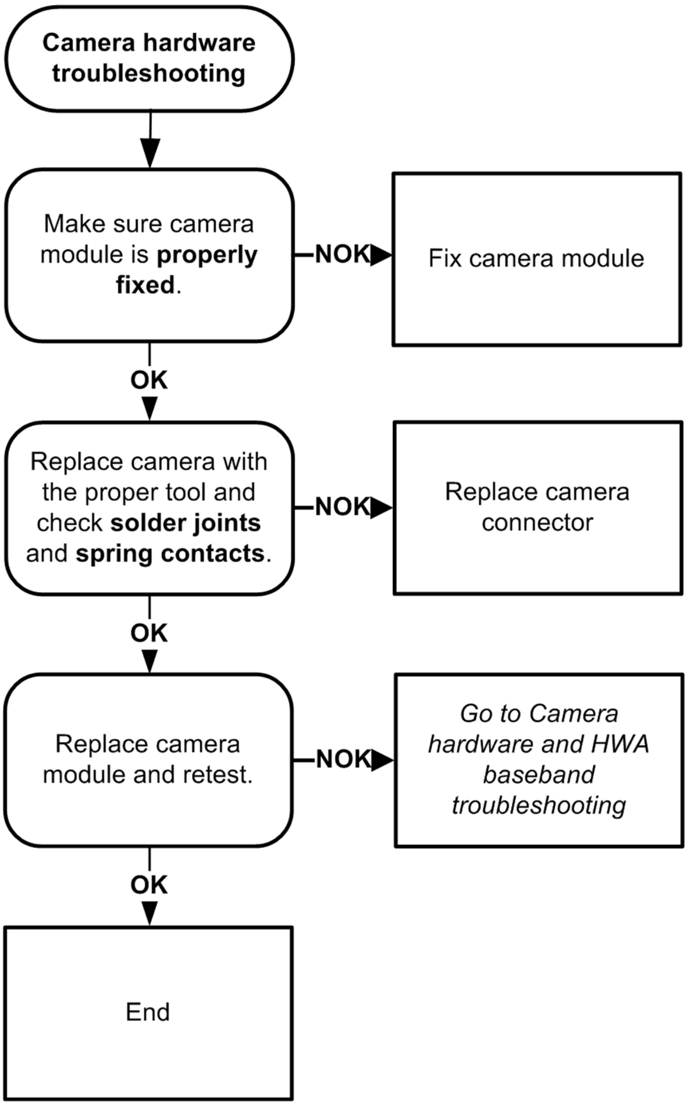
- Avoid bright fluorescent light, 50/60Hz electrical network or high artificial illumination levels
- If the phone is hot, let it rest for a while before taking the picture
- Make sure the optical system is clean
- Use highest possible resolution
- Make sure the light is sufficient (bright office lightning)
- Do not take the picture towards light source
- Hold the phone as still as possible when taking the picture
- Pictures should be taken both at infinity ~>2m and at macro distance ~10-15 cm in order to verify auto focus functionality

When *evaluating* a test picture, remember the following:

- The center of the picture is sharper than the edges
- If phone has auto focus: Remember that the white focussing frame which appears when the camera button is pressed halfway down, must turn green for auto focus lock. If the frame turns red, the camera is not focussed!
- The image may be blurred, though it does not show in the viewfinder
- Analyse the picture from your PC monitor, full colour setting is recommended
- If possible, compare with a picture of the same motive taken with a similar Nokia device

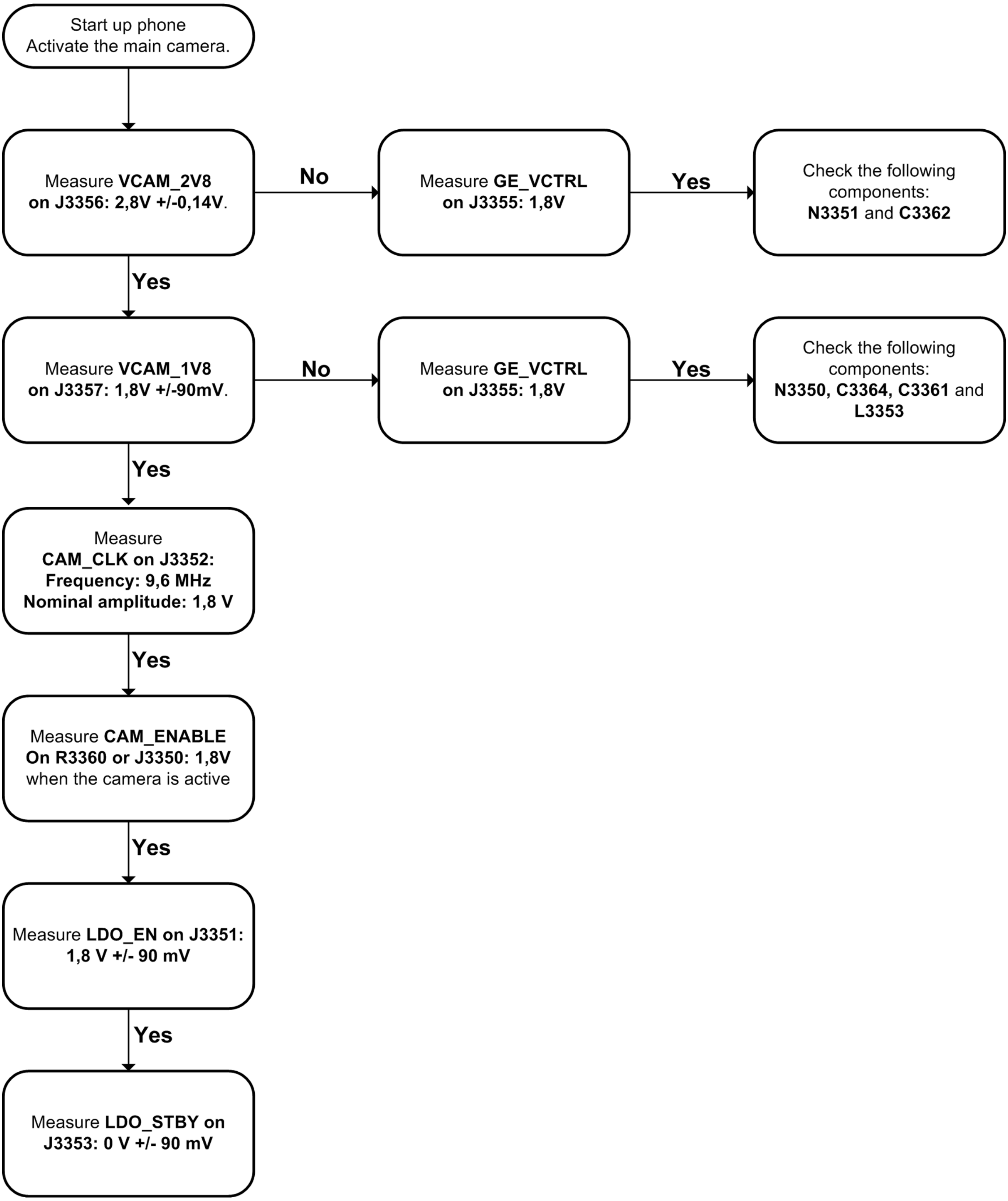
Camera hardware troubleshooting

Troubleshooting flow


Camera hardware troubleshooting
Make sure camera module is properly fixed.
NOK
Fix camera module
OK
Replace camera with the proper tool and check solder joints and spring contacts.
NOK
Replace camera connector
OK
Replace camera module and retest.
NOK
Go to Camera hardware and HWA baseband troubleshooting
OK
End

Camera hardware troubleshooting

Troubleshooting flow


Start up phone
Activate the main camera.
Measure VCAM_2V8 on J3356: 2,8V +/-0,14V.
No
Measure GE_VCTRL on J3355: 1,8V
Yes
Check the following components: N3351 and C3362
Yes
Measure VCAM_1V8 on J3357: 1,8V +/-90mV.
No
Measure GE_VCTRL on J3355: 1,8V
Yes
Check the following components: N3350, C3364, C3361 and L3353
Yes
Measure CAM_CLK on J3352: Frequency: 9,6 MHz Nominal amplitude: 1,8 V
Yes
Measure CAM_ENABLE On R3360 or J3350: 1,8V when the camera is active
Yes
Measure LDO_EN on J3351: 1,8 V +/- 90 mV
Yes
Measure LDO_STBY on J3353: 0 V +/- 90 mV

Small (front) camera troubleshooting

Evaluating videocall picture quality from small (front) camera

When testing the picture quality of a videocall, remember the following:

- Avoid bright fluorescent light, 50/60Hz electrical network or high artificial illumination levels
- Make sure the optical system is clean
- Make sure the light is suffiecient (bright office lightning)
- Do not take the picture towards light source
- Hold the phone as still as possible when evaluating the video call image quality.
- Distance should be approximately 40 cm

When *evaluating* the picture quality of a video call, remember the following:

> **Note:** Always use the "troubled" phone when evaluating a picture in a video call (top right corner of display). Do not evaluate the picture on the receiving phone.

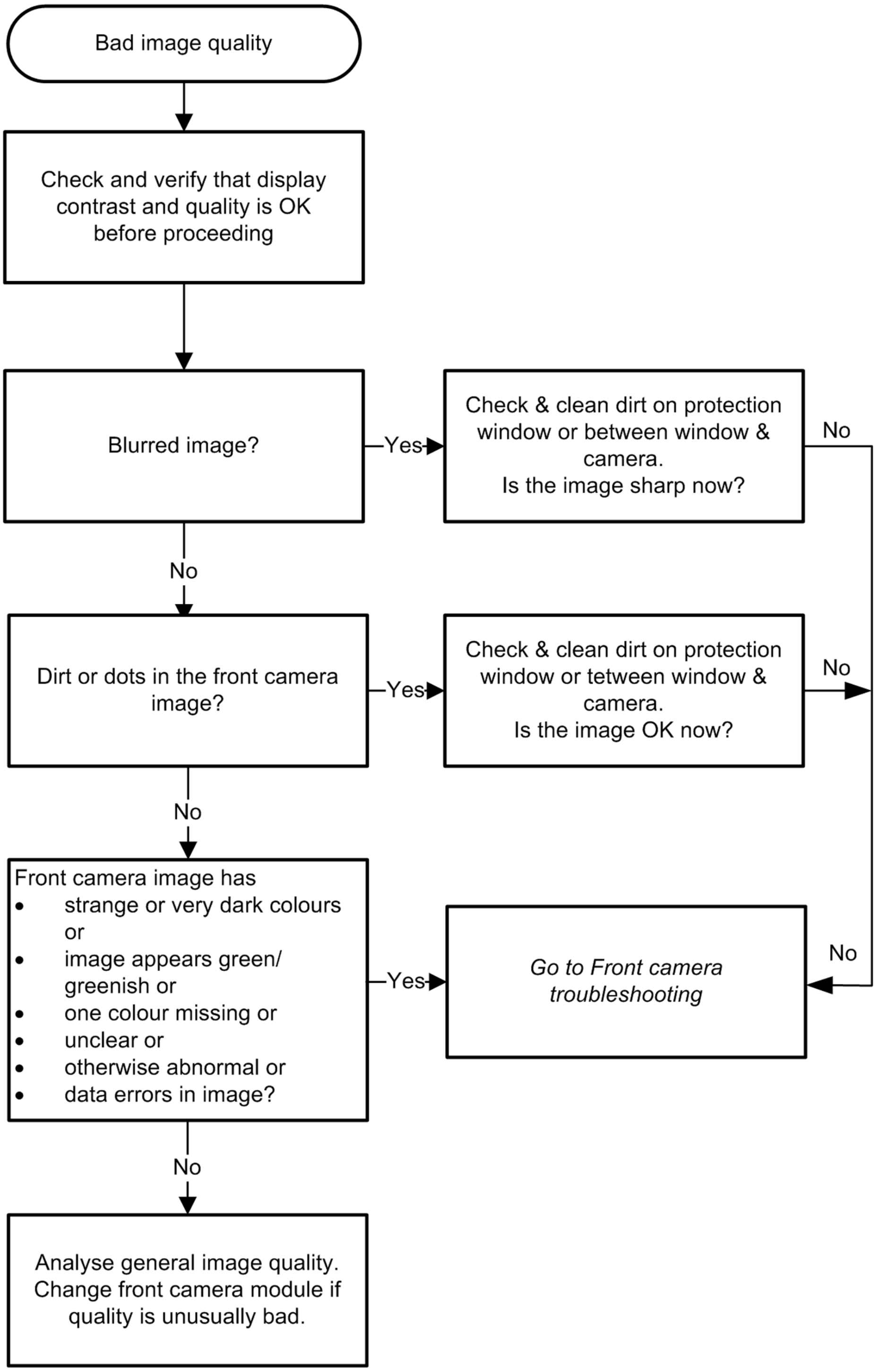
- The center of the picture is sharper than the edges
- If possible, compare with the picture on another Nokia device in a videocall, and of the same motive.

Small (front) camera bad image quality troubleshooting

Troubleshooting flow

***Note**: Phone must be in a video call for the front camera to be active.*

***Note:** Always use the "troubled" phone when evaluating a picture in a video call. Do not evaluate the picture on the receiving phone*

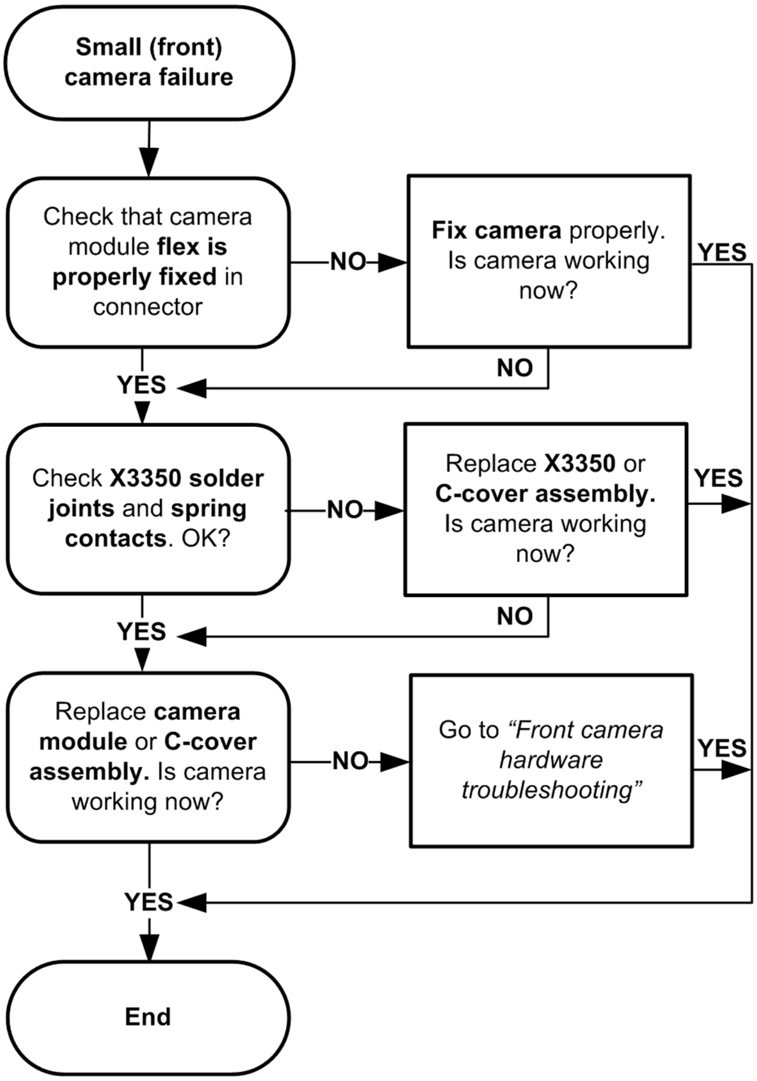

Bad image quality
Check and verify that display contrast and quality is OK before proceeding
Blurred image?
Yes
Check & clean dirt on protection window or between window & camera.
Is the image sharp now?
No
No
Dirt or dots in the front camera image?
Yes
Check & clean dirt on protection window or tetween window & camera.
Is the image OK now?
No
No
Front camera image has
• strange or very dark colours or
• image appears green/ greenish or
• one colour missing or
• unclear or
• otherwise abnormal or
• data errors in image?
Yes
Go to Front camera troubleshooting
No
No
Analyse general image quality. Change front camera module if quality is unusually bad.

Small (front) camera troubleshooting

Troubleshooting flow

***Note**: the phone must be in a video call for the front camera to be active. The front camera image is the small one in the upper right corner*

***Note:** Always use the "troubled" phone when evaluating a picture in a video call. Do not evaluate the picture on the receiving phone*

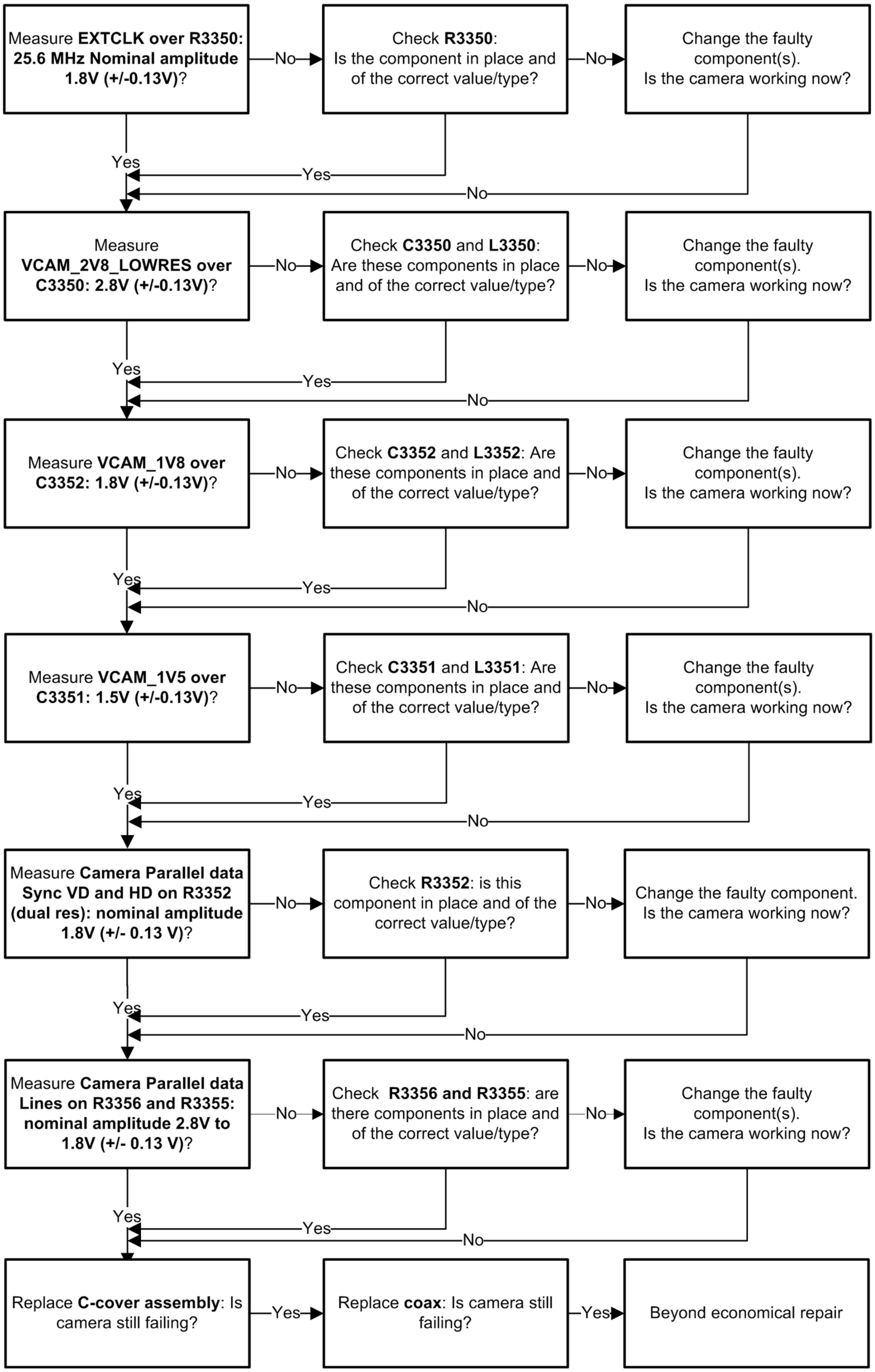

Small (front) camera failure
Check that camera module flex is properly fixed in connector
NO
Fix camera properly. Is camera working now?
YES
NO
YES
Check X3350 solder joints and spring contacts. OK?
NO
Replace X3350 or C-cover assembly. Is camera working now?
YES
NO
YES
Replace camera module or C-cover assembly. Is camera working now?
NO
Go to "Front camera hardware troubleshooting"
YES
YES
End

Small (front) camera hardware troubleshooting

Troubleshooting flow

Note: *the phone must be in a video call for the small (front) camera to be active with signals and voltages present*

Note: *Always use the "troubled" phone when evaluating a picture in a video call. Do not evaluate the picture on the receiving phone*



Measure **EXTCLK over R3350: 25.6 MHz Nominal amplitude 1.8V (+/-0.13V)**?

Check **R3350**: Is the component in place and of the correct value/type?

Change the faulty component(s). Is the camera working now?

Measure **VCAM_2V8_LOWRES over C3350: 2.8V (+/-0.13V)**?

Check **C3350** and **L3350**: Are these components in place and of the correct value/type?

Change the faulty component(s). Is the camera working now?

Measure **VCAM_1V8 over C3352: 1.8V (+/-0.13V)**?

Check **C3352** and **L3352**: Are these components in place and of the correct value/type?

Change the faulty component(s). Is the camera working now?

Measure **VCAM_1V5 over C3351: 1.5V (+/-0.13V)**?

Check **C3351** and **L3351**: Are these components in place and of the correct value/type?

Change the faulty component(s). Is the camera working now?

Measure **Camera Parallel data Sync VD and HD on R3352 (dual res): nominal amplitude 1.8V (+/- 0.13 V)**?

Check **R3352**: is this component in place and of the correct value/type?

Change the faulty component. Is the camera working now?

Measure **Camera Parallel data Lines on R3356 and R3355: nominal amplitude 2.8V to 1.8V (+/- 0.13 V)**?

Check **R3356 and R3355**: are there components in place and of the correct value/type?

Change the faulty component(s). Is the camera working now?

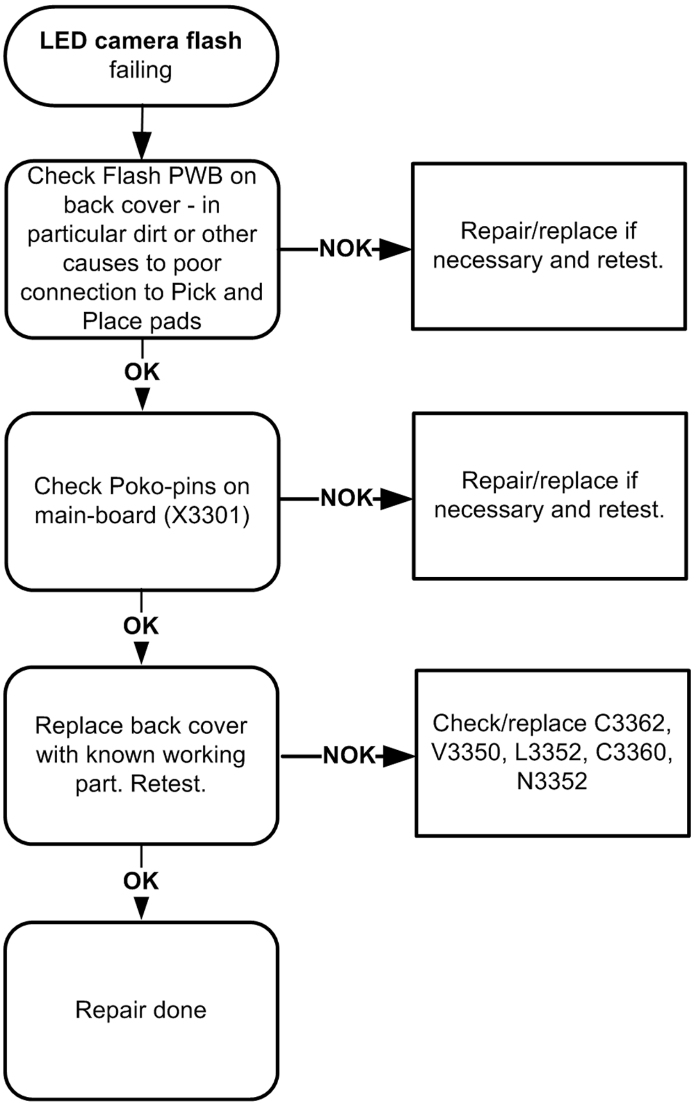
Replace **C-cover assembly**: Is camera still failing?

Replace **coax**: Is camera still failing?

Beyond economical repair

LED camera flash troubleshooting

Troubleshooting flow


LED camera flash failing
Check Flash PWB on back cover - in particular dirt or other causes to poor connection to Pick and Place pads
NOK
Repair/replace if necessary and retest.
OK
Check Poko-pins on main-board (X3301)
NOK
Repair/replace if necessary and retest.
OK
Replace back cover with known working part. Retest.
NOK
Check/replace C3362, V3350, L3352, C3360, N3352
OK
Repair done

Audio troubleshooting

Audio troubleshooting test instructions

Differential external earpiece and internal earpiece outputs can be measured either with a single-ended or a differential probe.

When measuring with a single-ended probe each output is measured against the ground.

Internal handsfree output is measured using a current probe, if a special low-pass filter designed for measuring a digital amplifier is not available. Note also that when using a current probe, the input signal frequency must be set to 2kHz.

The input signal for each loop test can be either single-ended or differential.

Required equipment

The following equipment is needed for the tests:

- Oscilloscope
- Function generator (sine waveform)
- 'Active speaker' or 'speaker and power amplifier'
- Sound level meter
- Current probe (Internal handsfree DPMA output measurement)
- Phoenix service software
- Battery voltage 3.7V

Test procedure

Audio can be tested using the Phoenix audio routings option. Three different audio loop paths can be activated:

- External microphone to Internal earpiece
- External microphone to Internal handsfree speaker
- Internal microphone to External earpiece

Each audio loop sets routing from the specified input to the specified output enabling a quick in-out test. Loop path gains are fixed and they cannot be changed using Phoenix. Correct pins and signals for each test are presented in the following table.

Phoenix audio loop tests and test results

The results presented in the table apply when no accessory is connected and battery voltage is set to 3.7V.

Earpiece, internal microphone and speaker are in place during measurement. Applying a headset accessory during measurement causes a significant drop in measured quantities.

The gain values presented in the table apply for a differential output vs. single-ended/differential input.

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Differential output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to External Earpiece	XMICP and GND	HSEAR R P, HSEAR R N and GND	-2.9	1000	720	1.2	NA
		HSEAR P, HSEAR N and GND					
	XMICN and GND	HSEAR R P, HSEAR R N and GND					
		HSEAR P, HSEAR N and GND					

Loop test	Input terminal	Output terminal	Path gain [dB] (fixed)	Input voltage [mVp-p]	Differential output voltage [mVp-p]	Output DC level [V]	Output current [mA]
External Mic to Internal Earpiece	XMICP and GND	EarP and GND	-4.5	1000	600	1.2	NA
		EarN and GND					
	XMICN and GND	EarP and GND					
		EarN and GND					
External Mic to Internal handsfree	XMICP and GND	B2102 pads	-5	1000	560	0	25mA (calc.)
	XMICN and GND	B2102 pads					
Internal Mic to External Earpiece	B2100 (OUT/GND)	HSEAR R P, HSEAR R N and GND	22.7	100	1360	1.2	NA
		HSEAR P, HSEAR N and GND					
		HSEAR R P, HSEAR R N and GND					
		HSEAR P, HSEAR N and GND					

Measurement data

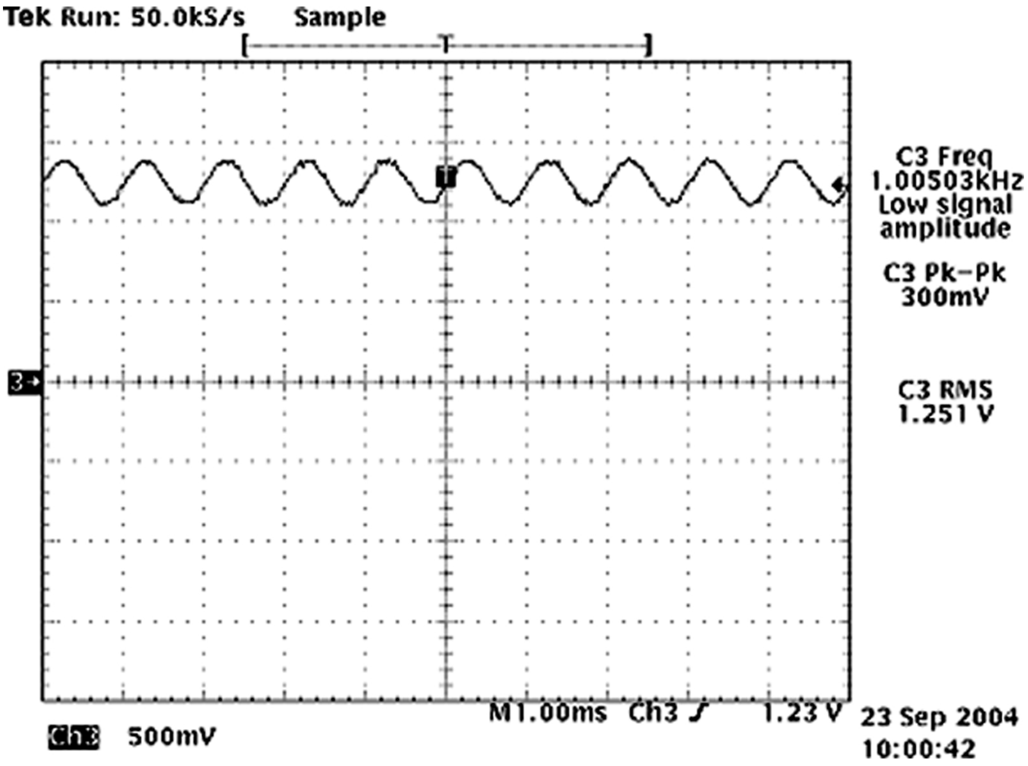
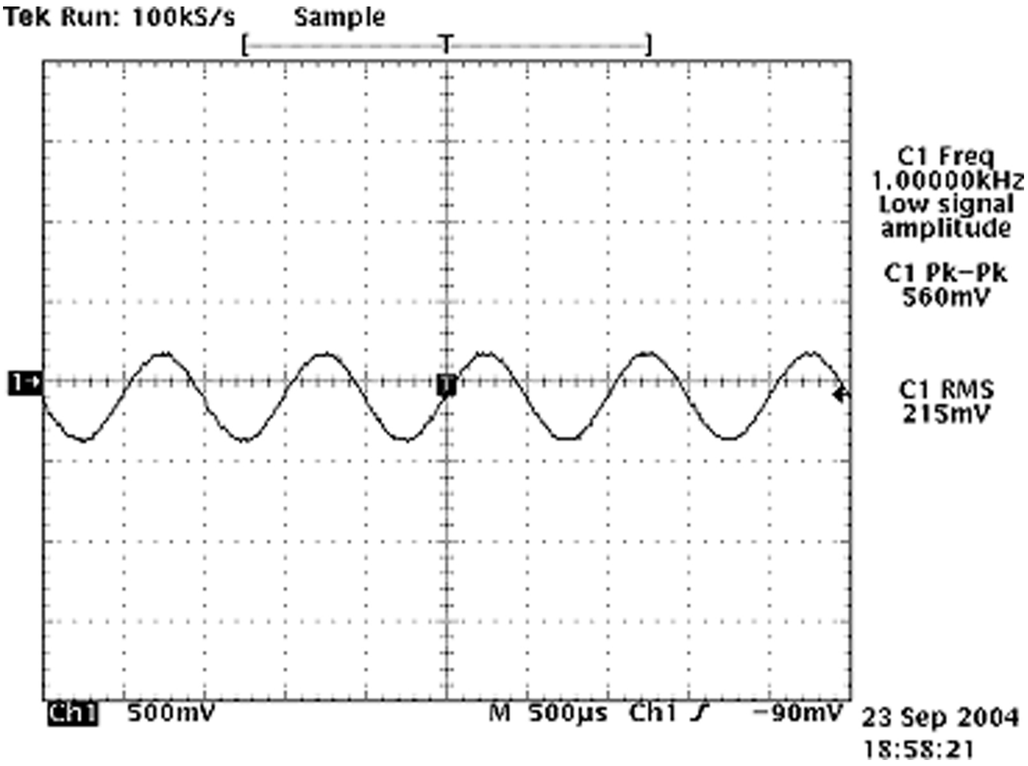


Figure 11 Single-ended output waveform of the Ext_in_HP_out measurement when earpiece is connected.



If a special low-pass filter designed for measuring digital amplifiers is unavailable, the measurement must be performed with a current probe and the input signal frequency must be 2kHz.

Figure 12 Differential output waveform of the Ext_in_IHF_out out loop measurement when speaker is connected.

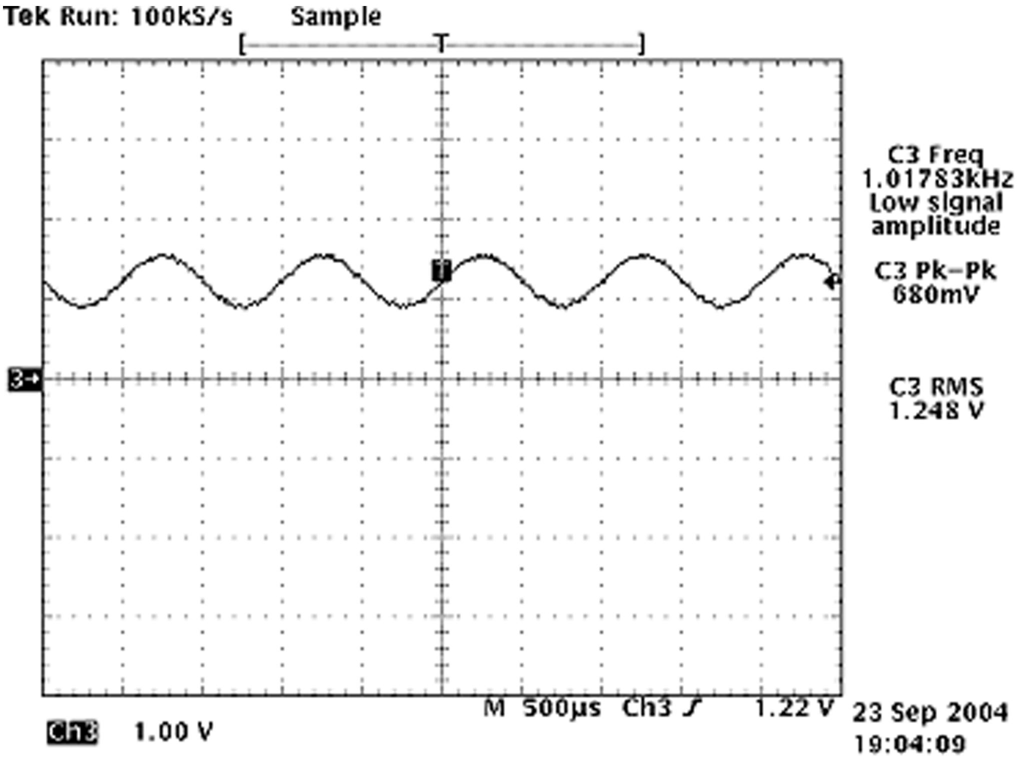
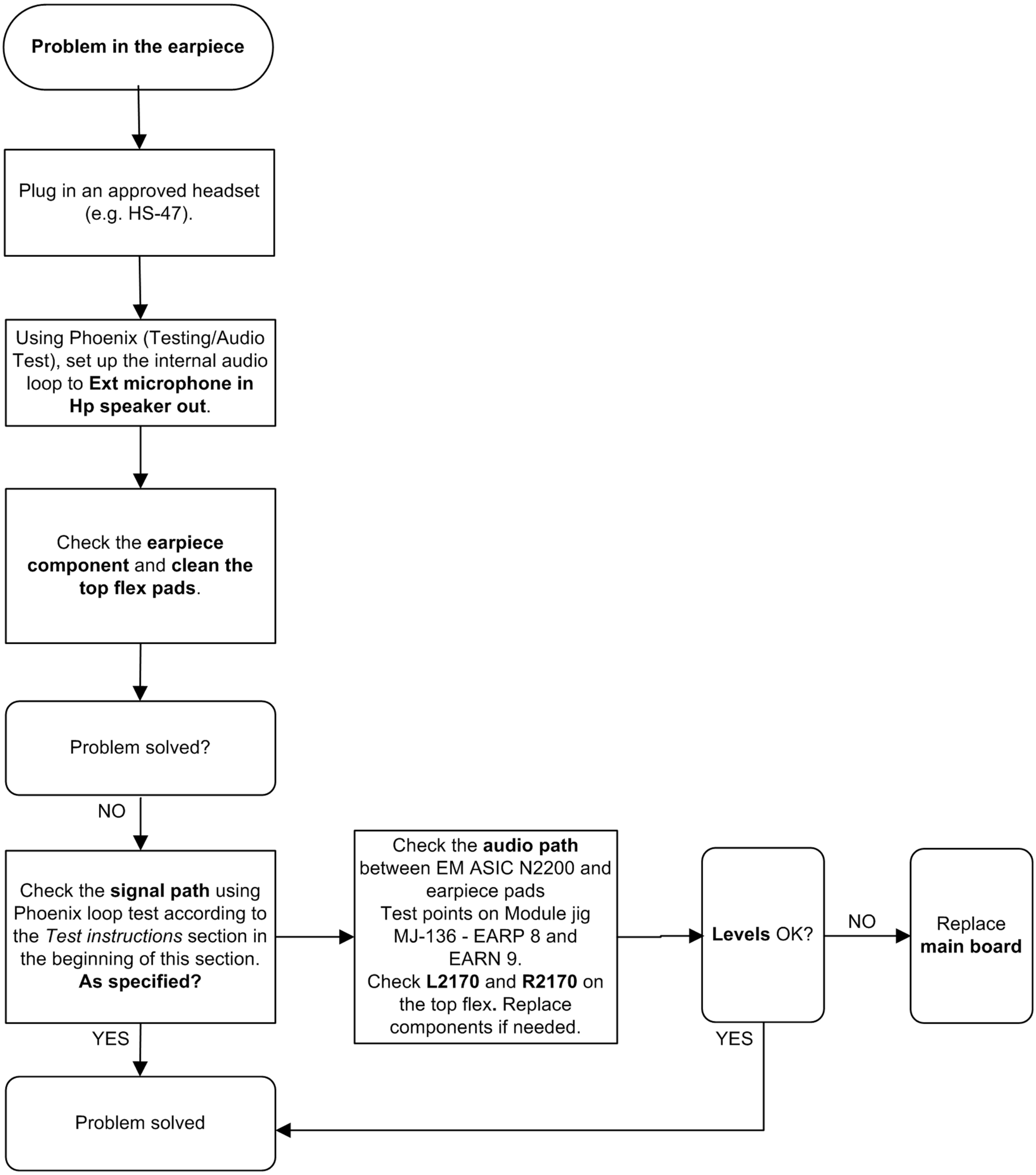


Figure 13 Single-ended output waveform of the HP_in_Ext_out loop when microphone is connected.

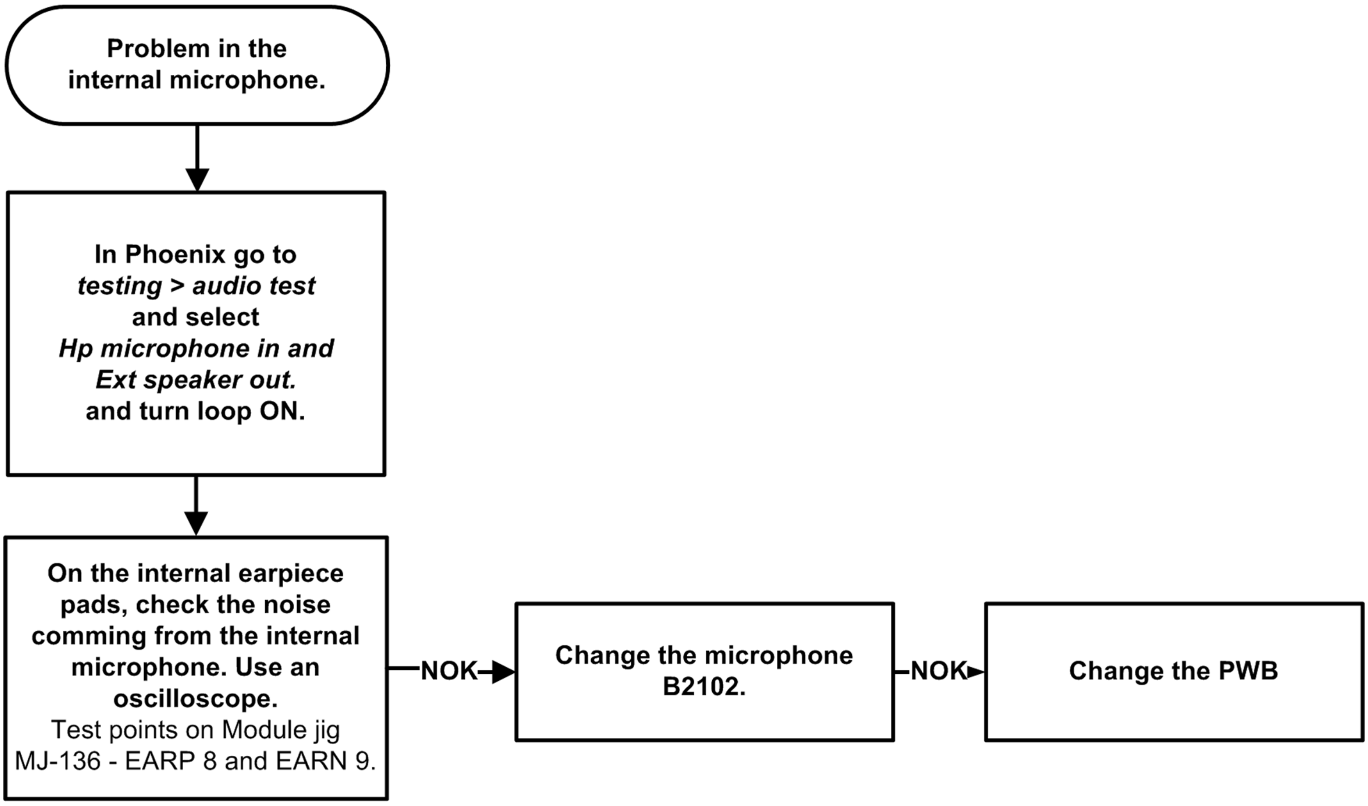
Internal earpiece troubleshooting

Troubleshooting flow


Problem in the earpiece
Plug in an approved headset (e.g. HS-47).
Using Phoenix (Testing/Audio Test), set up the internal audio loop to **Ext microphone in Hp speaker out**.
Check the **earpiece component** and **clean the top flex pads**.
Problem solved?
NO
Check the **signal path** using Phoenix loop test according to the *Test instructions* section in the beginning of this section. **As specified?**
YES
Problem solved
Check the **audio path** between EM ASIC N2200 and earpiece pads Test points on Module jig MJ-136 - EARP 8 and EARN 9. Check **L2170** and **R2170** on the top flex**.** Replace components if needed.
Levels OK?
NO
YES
Replace **main board**

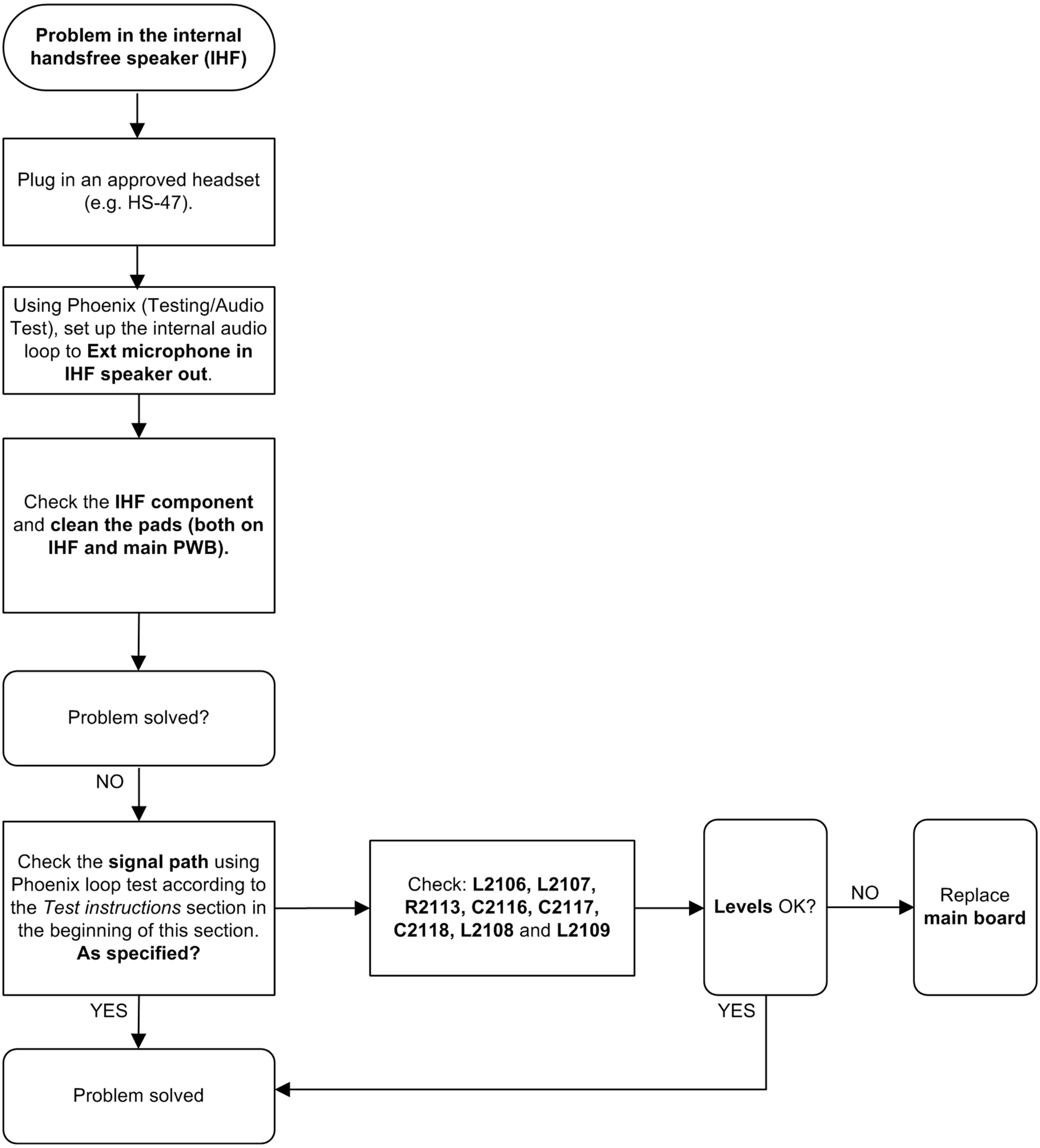
Internal microphone troubleshooting

Troubleshooting flow


Problem in the internal microphone.
In Phoenix go to *testing > audio test* and select *Hp microphone in and Ext speaker out.* and turn loop ON.
On the internal earpiece pads, check the noise comming from the internal microphone. Use an oscilloscope.
Test points on Module jig MJ-136 - EARP 8 and EARN 9.
NOK
Change the microphone B2102.
NOK
Change the PWB

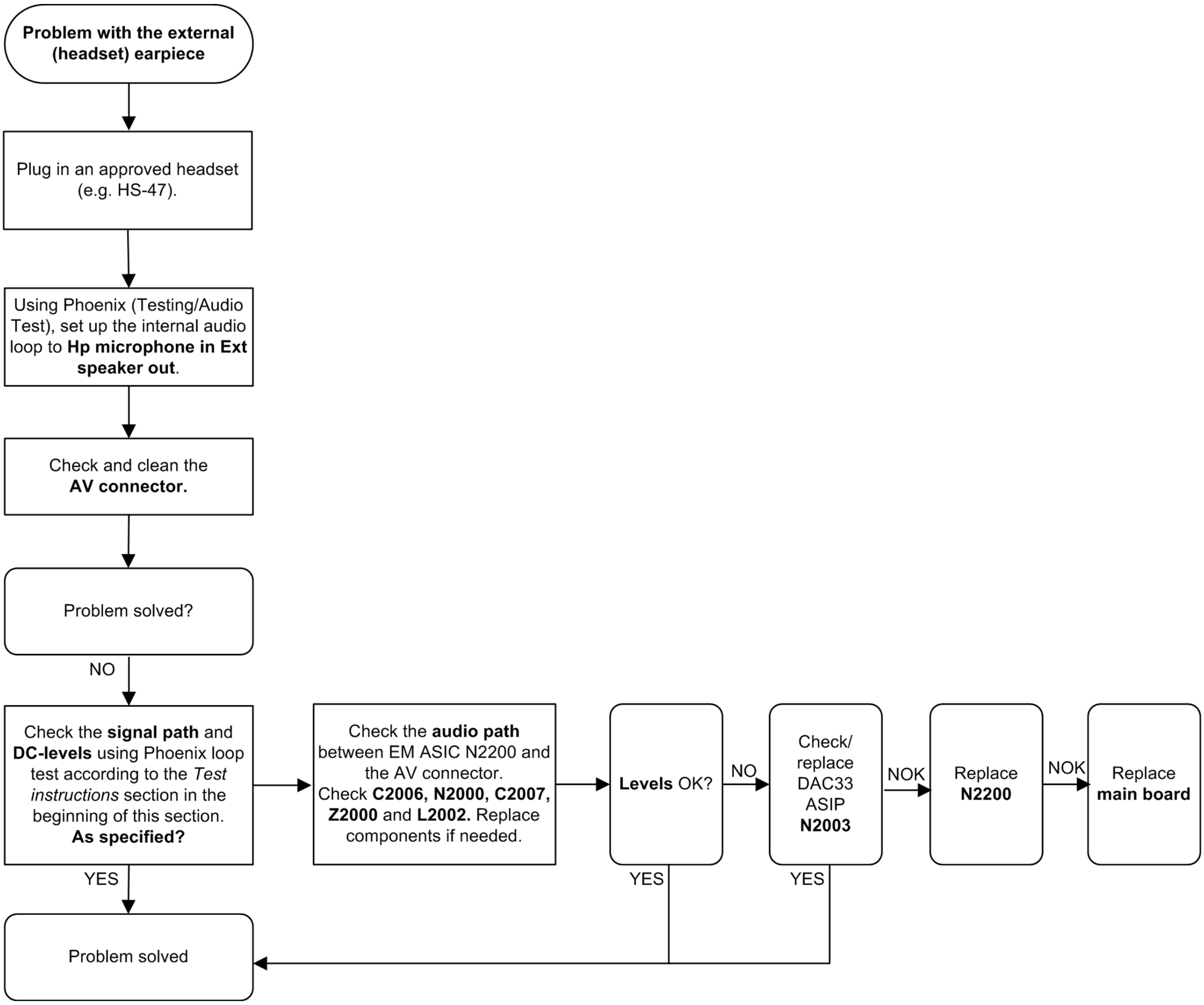
Internal handsfree (IHF) troubleshooting

Troubleshooting flow


Problem in the internal handsfree speaker (IHF)
Plug in an approved headset (e.g. HS-47).
Using Phoenix (Testing/Audio Test), set up the internal audio loop to Ext microphone in IHF speaker out.
Check the IHF component and clean the pads (both on IHF and main PWB).
Problem solved?
NO
Check the signal path using Phoenix loop test according to the Test instructions section in the beginning of this section. As specified?
Check: L2106, L2107, R2113, C2116, C2117, C2118, L2108 and L2109
Levels OK?
NO
Replace main board
YES
YES
Problem solved

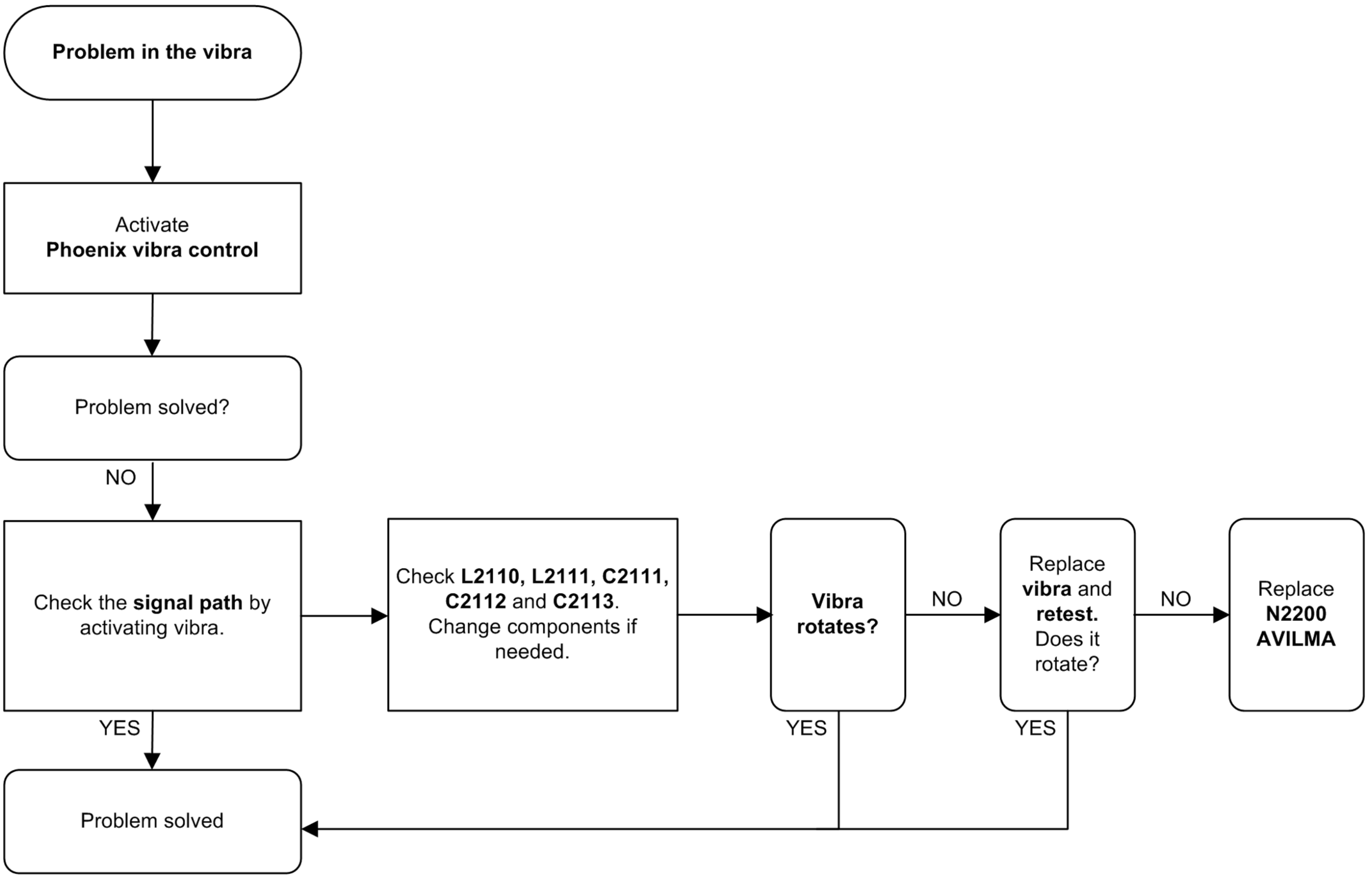
External earpiece troubleshooting

Troubleshooting flow


Problem with the external (headset) earpiece
Plug in an approved headset (e.g. HS-47).
Using Phoenix (Testing/Audio Test), set up the internal audio loop to Hp microphone in Ext speaker out.
Check and clean the AV connector.
Problem solved?
NO
Check the signal path and DC-levels using Phoenix loop test according to the Test instructions section in the beginning of this section. As specified?
YES
Problem solved
Check the audio path between EM ASIC N2200 and the AV connector. Check C2006, N2000, C2007, Z2000 and L2002. Replace components if needed.
Levels OK?
NO
YES
Check/ replace DAC33 ASIP N2003
YES
NOK
Replace N2200
NOK
Replace main board

Vibra troubleshooting

Troubleshooting flow


Problem in the vibra
Activate
Phoenix vibra control
Problem solved?
NO
Check the signal path by activating vibra.
Check L2110, L2111, C2111, C2112 and C2113. Change components if needed.
Vibra rotates?
NO
Replace vibra and retest. Does it rotate?
NO
Replace N2200 AVILMA
YES
YES
YES
Problem solved

Baseband manual tuning guide

Certificate restoring for BB5 products

Context

This procedure is performed when the device certificate is corrupted for some reason.

All tunings (RF & Baseband, UI) must be done after performing the certificate restoring procedure.

The procedure for certificate restoring is the following:

- Flash the phone with the latest available software using FPS-8 or FPS-10.

  Note: USB flashing does not work for a dead BB5 phone.
- Create a request file.
- Send the file to Nokia by e-mail. Use the following addresses depending on your location:
  - APAC: sydney.service@nokia.com
  - CHINA: repair.ams@nokia.com
  - E&A: salo.repair@nokia.com
  - AMERICAS: fls1.usa@nokia.com
- When you receive a reply from Nokia, carry out certificate restoring.
- Tune the phone completely.

Note: SX-4 smart card is needed.

- If the phone resets after certificate restoring, reflash the phone again.

Required equipment and setup:

- *Phoenix* service software v 2007.19 or newer.
- The latest phone model specific *Phoenix* data package.
- PKD-1 dongle
- SX-4 smart card (Enables BB5 testing and tuning features)
- External smart card reader

  Note: The smart card reader is only needed when FPS-8 is used. FPS-10 has an integrated smart card reader.

- Activated FPS-8 flash prommer **OR** FPS-10 flash prommer
- Flash update package 03.18.004 or newer for FPS-8 or FPS-10 flash prommers
- CU-4 control unit
- USB cable from PC USB Port to CU-4 control unit
- Phone model specific adapter for CU-4 control unit
- PCS-1 cable to power CU-4 from external power supply
- XCS-4 modular cable between flash prommer and CU-4

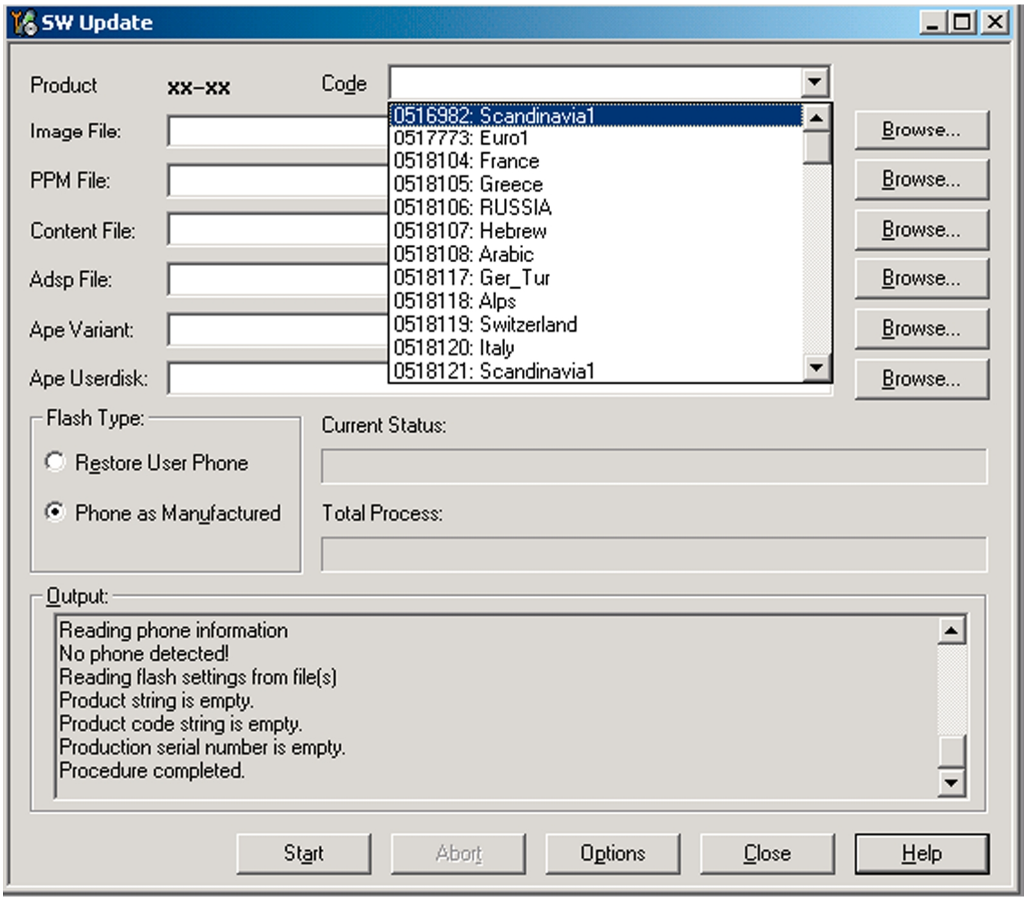
  Note: CU-4 must be supplied with +12 V from an external power supply in all steps of certificate restoring.

Steps

1. Program the phone software.
   - i Start *Phoenix* and login. Make sure the connection has been managed correctly for FPS-8 or FPS-10.
   - ii Update the phone MCU software to the latest available version.

     If the new flash is empty and the phone cannot communicate with *Phoenix*, reflash the phone.
   - iii Choose the product manually from **File→Open Product** , and click **OK**.

     Wait for the phone type designator (e.g. “RM-1”) to be displayed in the status bar.
   - iv Go to **Flashing→SW Update** and wait until *Phoenix* reads the product data as shown in the following picture.


SW Update
Image File:
PPM File:
Content File:
Adsp File:
Ape Variant:
Ape Userdisk:
Browse...
Browse...
Browse...
Browse...
Browse...
Browse...
Current Status:
Total Process:
Start
Abort
Options
Close
Help

Product xx–xx

Code

0516982: Scandinavia1
0517773: Euro1
0518104: France
0518105: Greece
0518106: RUSSIA
0518107: Hebrew
0518108: Arabic
0518117: Ger_Tur
0518118: Alps
0518119: Switzerland
0518120: Italy
0518121: Scandinavia1

Flash Type:
○ Restore User Phone
● Phone as Manufactured

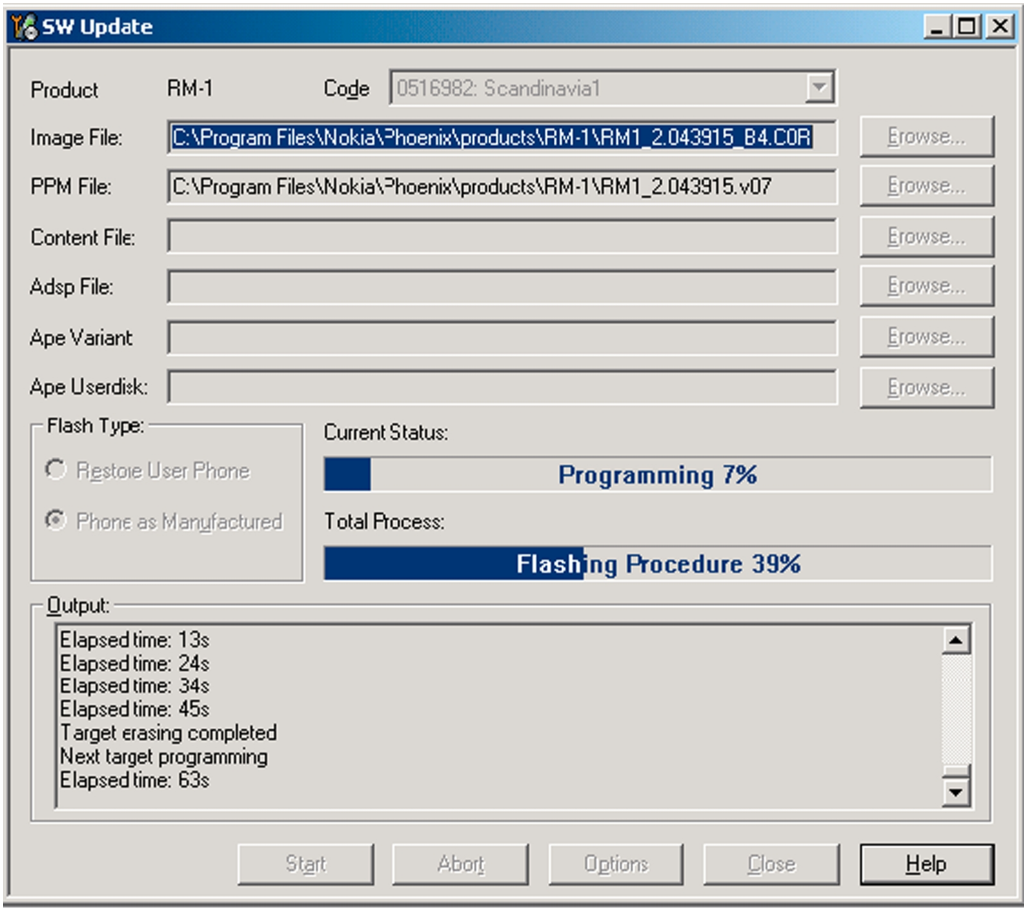
Output:

```
Reading phone information
No phone detected!
Reading flash settings from file(s)
Product string is empty.
Product code string is empty.
Production serial number is empty.
Procedure completed.
```

Product	is automatically set according to the phone support module which was opened manually, but the flash files cannot be found because the correct data cannot be read from the phone automatically.
Code	must be chosen manually, it determines the correct flash files to be used. Please choose the correct product code (can be seen in the phone type label) from the dropdown list.
Flash Type	must be set to **Phone as Manufactured**.

- To continue, click **Start**.

  Progress bars and messages on the screen show actions during phone programming, please wait.



Product: RM-1
Code: 0516982: Scandinavia1
Image File: C:\Program Files\Nokia\Phoenix\products\RM-1\RM1_2.043915_B4.C0R
PPM File: C:\Program Files\Nokia\Phoenix\products\RM-1\RM1_2.043915.v07
Flash Type: ○ Restore User Phone ● Phone as Manufactured
Current Status: Programming 7%
Total Process: Flashing Procedure 39%

```
Elapsed time: 13s
Elapsed time: 24s
Elapsed time: 34s
Elapsed time: 45s
Target erasing completed
Next target programming
Elapsed time: 63s
```

SW Update
Content File:
Adsp File:
Ape Variant
Ape Userdisk:
Browse...
Output:
Start
Abort
Options
Close
Help

Programming is completed when *Flashing Completed* message is displayed.

The product type designator and MCU SW version are displayed in the status bar.

vi Close the *SW Update* window and then choose **File→Close Product** .

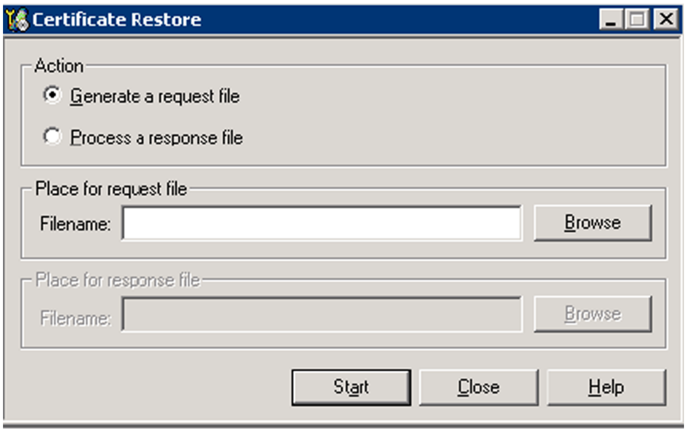
2. Create a *Request* file.

For this procedure, you must supply +12 V to CU-4 from an external power supply.

i To connect the phone with *Phoenix*, choose **File→Scan Product** .

ii Choose **Tools→Certificate Restore** .

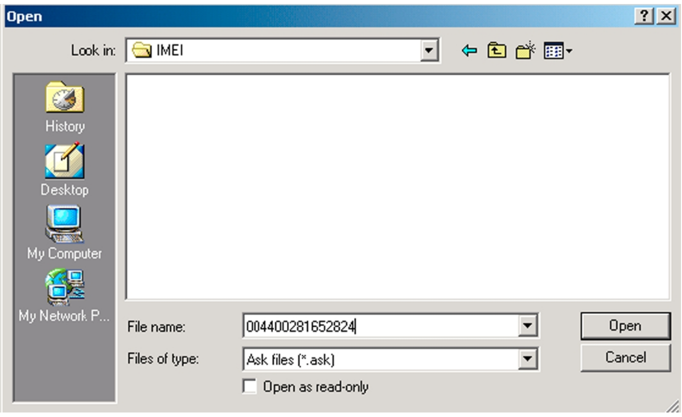
iii To choose a location for the request file, click **Browse**.



Action: ● Generate a request file ○ Process a response file

Certificate Restore
Place for request file
Filename:
Browse
Place for response file
Filename:
Browse
Start
Close
Help

iv Name the file so that you can easily identify it, and click **Open**.


Open
History
Desktop
My Computer
My Network P...
Open
Cancel

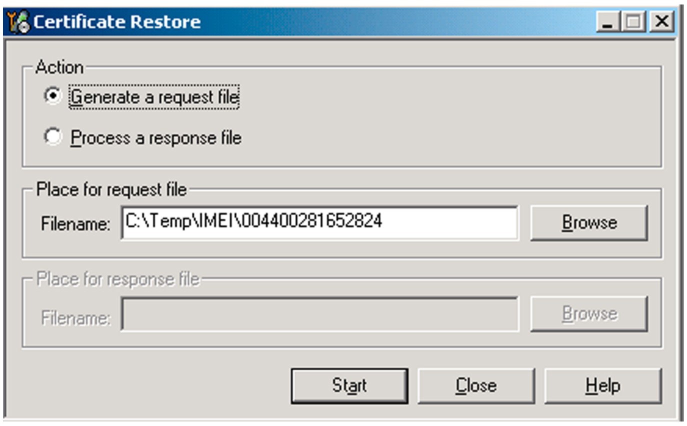
Look in: IMEI

File name: 004400281652824

Files of type: Ask files (*.ask)

☐ Open as read-only

The name of the file and its location are shown.


Certificate Restore
Browse
Browse
Start
Close
Help

Action

● Generate a request file

○ Process a response file

Place for request file

Filename: C:\Temp\IMEI\004400281652824

Place for response file

Filename:

v To create the *Request* file, click **Start**.

vi When the file for certificate restore has been created, send it to Nokia as an e-mail attachment.

3. Restore certificate.

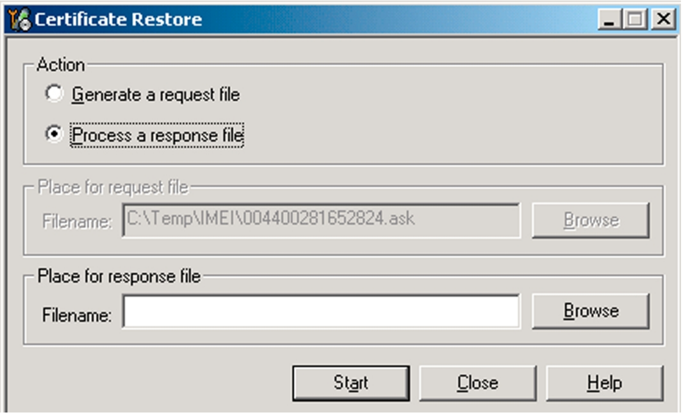
   For this procedure, you must supply +12 V to CU-4 from an external power supply.

   i Save the reply file sent by Nokia to your computer.

   ii Start *Phoenix* service software.

   iii Choose **File→Scan Product** .

iv From the **Tools** menu, choose **Certificate Restore** and select **Process a response file** in the *Action* pane.


Certificate Restore
Action
Generate a request file
Process a response file
Place for request file
Place for response file
Browse
Browse
Start
Close
Help

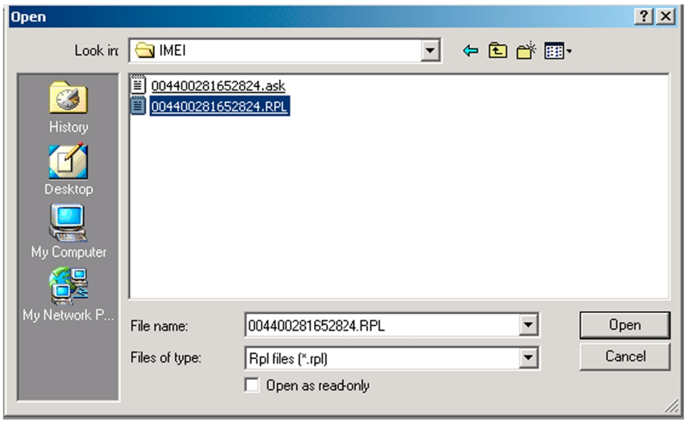
○ Generate a request file
● Process a response file

Filename: C:\Temp\IMEI\004400281652824.ask

Filename:

v To choose the location where response file is saved, click **Browse**.

vi Click **Open**.


Open
History
Desktop
My Computer
My Network P...
Open
Cancel

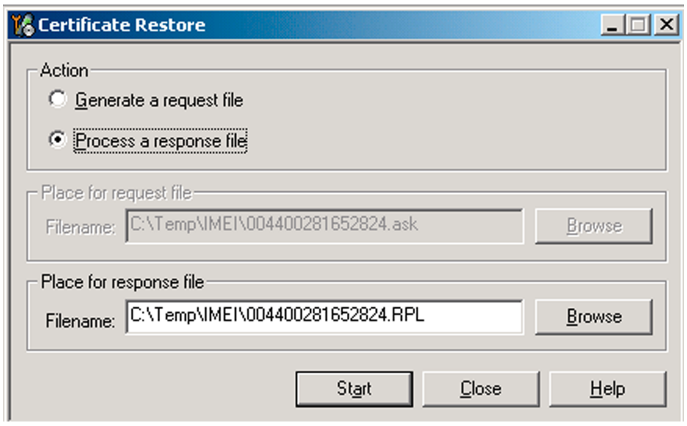
Look in: IMEI

004400281652824.ask
004400281652824.RPL

File name: 004400281652824.RPL
Files of type: Rpl files (*.rpl)
☐ Open as read-only

The name of the file and the path where it is located are shown.

vii To write the file to phone, click **Start**.


Certificate Restore
Action
Generate a request file
Process a response file
Place for request file
Place for response file
Browse
Browse
Start
Close
Help

○ Generate a request file
● Process a response file

Filename: C:\Temp\IMEI\004400281652824.ask

Filename: C:\Temp\IMEI\004400281652824.RPL

Next actions

After a successful rewrite, you must retune the phone completely by using *Phoenix* tuning functions.

Important: Perform all tunings: RF, BB, and UI.

Energy management calibration

Prerequisites

Energy Management (EM) calibration is performed to calibrate the setting (gain and offset) of AD converters in several channels (that is, **battery voltage**, **BSI**, **battery current**) to get an accurate AD conversion result.

Hardware setup:

- An external power supply is needed.
- Supply 12V DC from an external power supply to CU-4 to power up the phone.
- The phone must be connected to a CU-4 control unit with a product-specific flash adapter.

Steps

1. Place the phone to the docking station adapter (CU-4 is connected to the adapter).
2. Start *Phoenix* service software.
3. Choose **File**→ **Scan Product.**
4. Choose **Tuning**→**Energy Management Calibration.**
5. To show the current values in the phone memory, click **Read**, and check that communication between the phone and CU-4 works.
6. Check that the **CU-4 used** check box is checked.
7. Select the item(s) to be calibrated.

   Note: ADC calibration has to be performed before other item(s). However, if all calibrations are selected at the same time, there is no need to perform the ADC calibration first.

8. Click **Calibrate**.

   The calibration of the selected item(s) is carried out automatically.

   The candidates for the new calibration values are shown in the *Calculated values* column. If the new calibration values seem to be acceptable (please refer to the following "Calibration value limits" table), click **Write** to store the new calibration values to the phone permanent memory.

Table 6 Calibration value limits

Parameter	Min.	Max.
ADC Offset	-20	20
ADC Gain	12000	14000
BSI Gain	1100	1300
VBAT Offset	2400	2650
VBAT Gain	19000	23000
VCHAR Gain	N/A	N/A
IBAT (ICal) Gain	7750	12250

9. Click **Read**, and confirm that the new calibration values are stored in the phone memory correctly. If the values are not stored to the phone memory, click **Write** and/or repeat the procedure again.
10. To end the procedure, close the *Energy Management Calibration* window.

4 — RF troubleshooting

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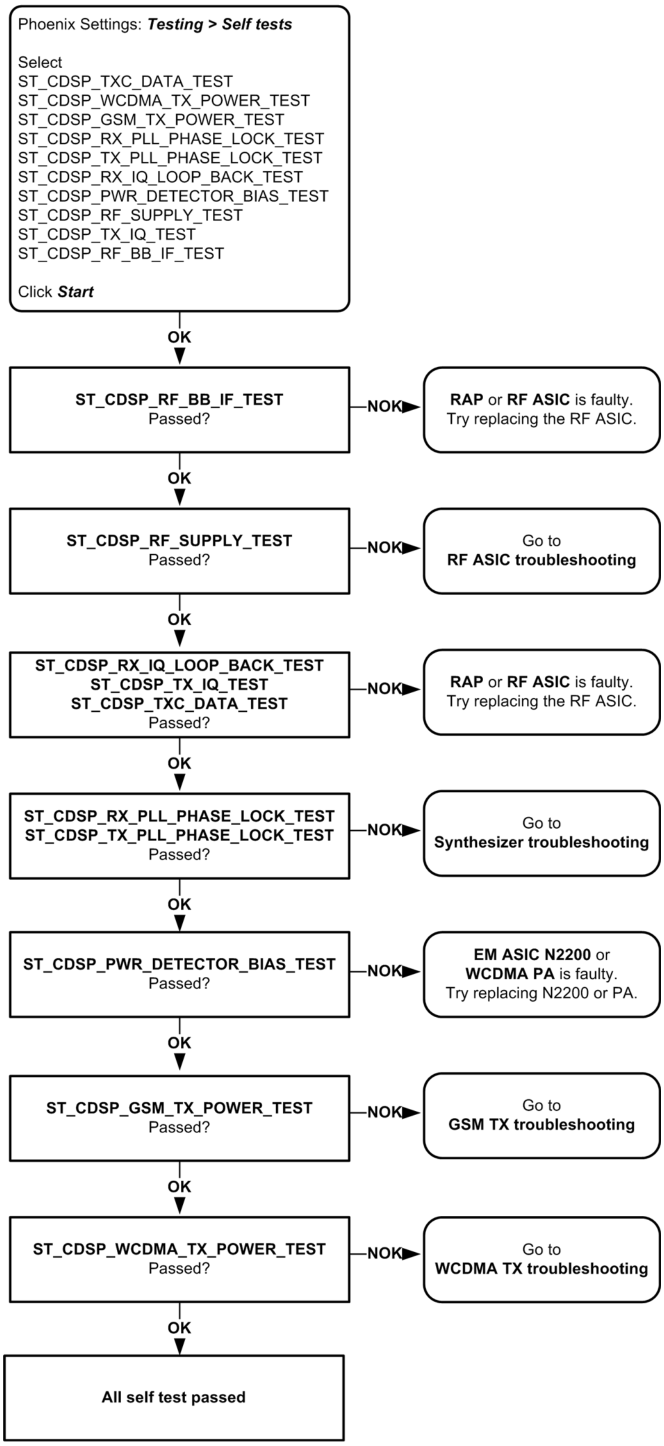
RF self tests in Phoenix

Context

Always start the troubleshooting procedure by running the Phoenix self tests. If a test fails, please follow the diagram below.

Troubleshooting flow


Phoenix Settings: *Testing > Self tests*
Select
ST_CDSP_TXC_DATA_TEST
ST_CDSP_WCDMA_TX_POWER_TEST
ST_CDSP_GSM_TX_POWER_TEST
ST_CDSP_RX_PLL_PHASE_LOCK_TEST
ST_CDSP_TX_PLL_PHASE_LOCK_TEST
ST_CDSP_RX_IQ_LOOP_BACK_TEST
ST_CDSP_PWR_DETECTOR_BIAS_TEST
ST_CDSP_RF_SUPPLY_TEST
ST_CDSP_TX_IQ_TEST
ST_CDSP_RF_BB_IF_TEST
Click *Start*
OK
ST_CDSP_RF_BB_IF_TEST Passed?
NOK
RAP or RF ASIC is faulty. Try replacing the RF ASIC.
OK
ST_CDSP_RF_SUPPLY_TEST Passed?
NOK
Go to RF ASIC troubleshooting
OK
ST_CDSP_RX_IQ_LOOP_BACK_TEST ST_CDSP_TX_IQ_TEST ST_CDSP_TXC_DATA_TEST Passed?
NOK
RAP or RF ASIC is faulty. Try replacing the RF ASIC.
OK
ST_CDSP_RX_PLL_PHASE_LOCK_TEST ST_CDSP_TX_PLL_PHASE_LOCK_TEST Passed?
NOK
Go to Synthesizer troubleshooting
OK
ST_CDSP_PWR_DETECTOR_BIAS_TEST Passed?
NOK
EM ASIC N2200 or WCDMA PA is faulty. Try replacing N2200 or PA.
OK
ST_CDSP_GSM_TX_POWER_TEST Passed?
NOK
Go to GSM TX troubleshooting
OK
ST_CDSP_WCDMA_TX_POWER_TEST Passed?
NOK
Go to WCDMA TX troubleshooting
OK
All self test passed

General RF troubleshooting

Introduction to RF troubleshooting

Most RF semiconductors are static discharge sensitive

ESD protection must be applied during repair (ground straps and ESD soldering irons).

Pre-baking

These parts are moisture sensitive and must be pre-baked prior to soldering:

- RFIC N7505
- Front End Module (FEM) N7520

Discrete components

In addition to the key-components, there are a number of discrete components (resistors, inductors and capacitors) for which troubleshooting is done mainly by *visual inspection*.

Capacitors: check for short circuits.

Resistors: check value with an ohm meter.

Note: In-circuit measurements should be evaluated carefully

Measuring equipment

All measurements should be done using:

- An oscilloscope for low frequency and DC measurements. Recommended probe: 10:1, 10Mohm//8pF.
- A radio communication tester including RF generator and spectrum analyser, for example Rohde & Schwarz CMU200. (Alternatively a spectrum analyser and an RF generator can be used. Some tests in this guide are not possible to perform if this solution is chosen).

Note: A mobile phone WCDMA transmitter should never be tested with full TX power (only it possible to perform the measurements in a good RF-shielded room). Even low power WCDMA transmitters may disturb nearby WCDMA networks and cause problems to 3G cellular phone communication in a wide area.

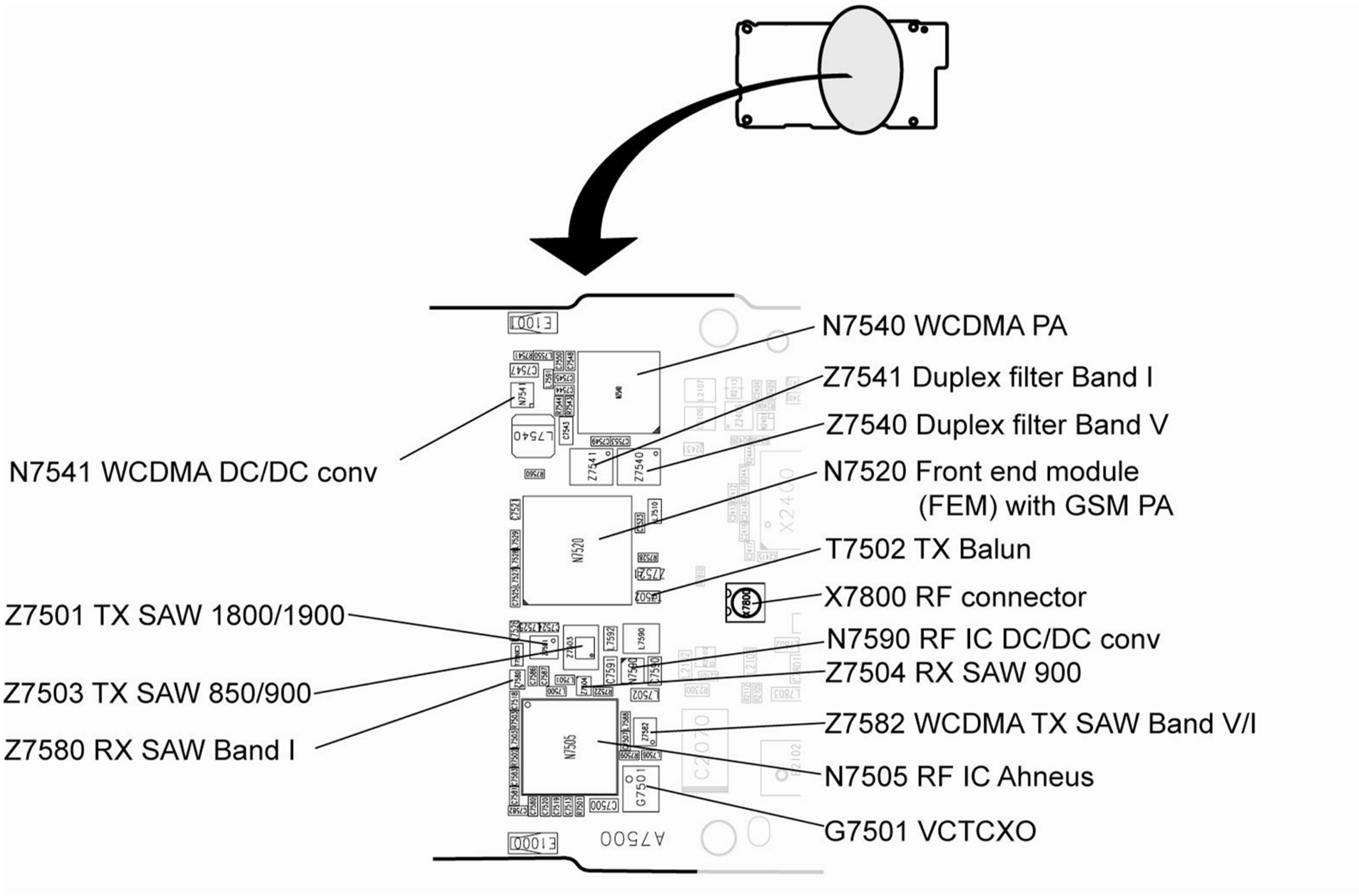
Note: All measurements with an RF coupler should be performed in an RF-shielded environment because nearby base stations can disturb sensitive receiver measurements. If there is no possibility to use RF shielded environment, testing at frequencies of nearby base stations should be avoided.

Level of repair

The scope of this guideline is to enable repairs at key-component level. Some key-components are not accessible, i.e. not replaceable. Please refer to the list of *Non replaceable RF components*.

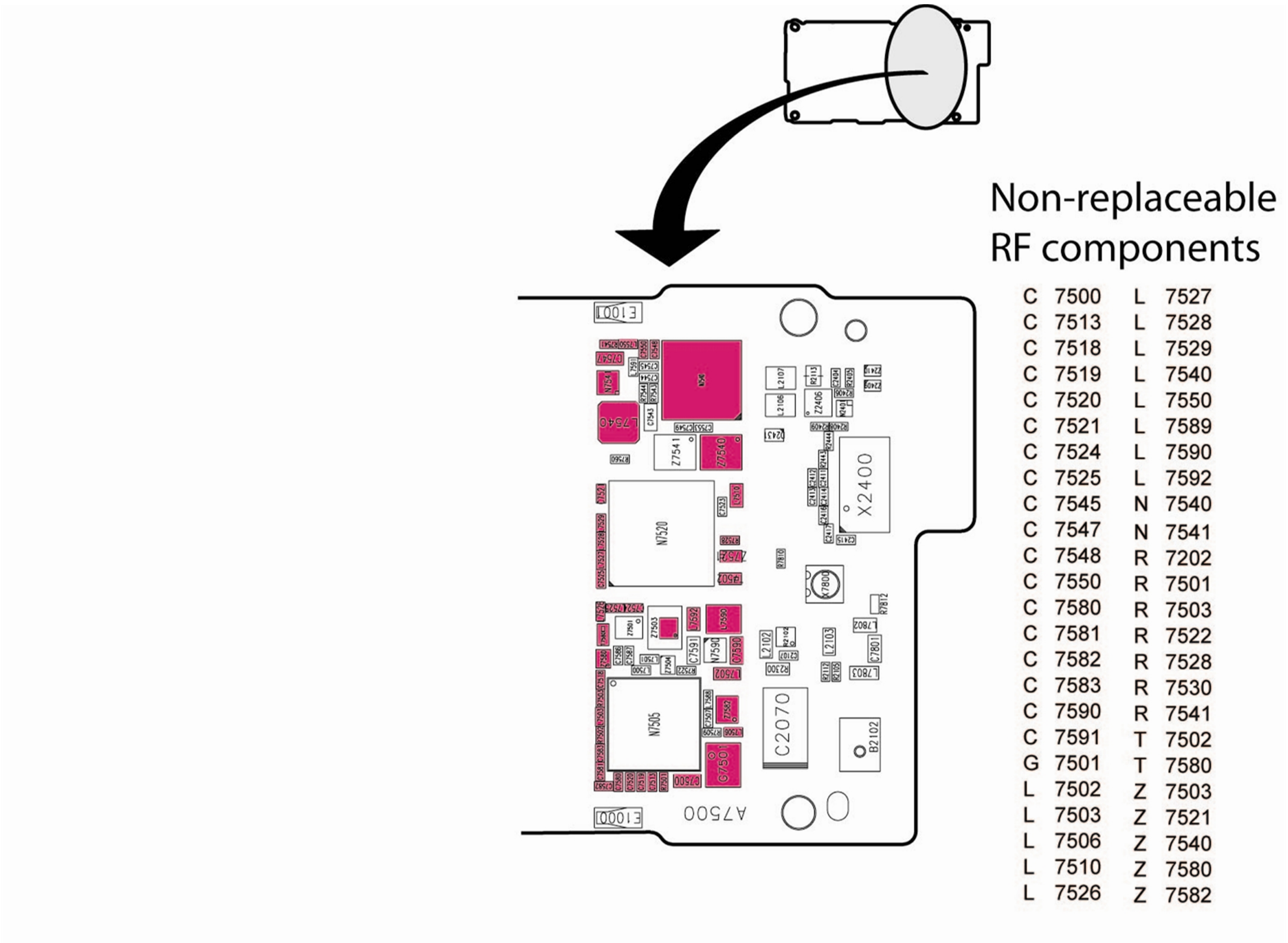
Note: If the RF shieldning can is removed (for measurement or repair), it must always be replaced with a new one.

RF key components


N7540 WCDMA PA
Z7541 Duplex filter Band I
Z7540 Duplex filter Band V
N7541 WCDMA DC/DC conv
N7520 Front end module (FEM) with GSM PA
T7502 TX Balun
X7800 RF connector
Z7501 TX SAW 1800/1900
N7590 RF IC DC/DC conv
Z7503 TX SAW 850/900
Z7504 RX SAW 900
Z7582 WCDMA TX SAW Band V/I
Z7580 RX SAW Band I
N7505 RF IC Ahneus
G7501 VCTCXO

Non-replaceable RF components

The following RF components cannot be replaced because of their location on the PWB:


Non-replaceable
RF components
C 7500
C 7513
C 7518
C 7519
C 7520
C 7521
C 7524
C 7525
C 7545
C 7547
C 7548
C 7550
C 7580
C 7581
C 7582
C 7583
C 7590
C 7591
G 7501
L 7502
L 7503
L 7506
L 7510
L 7526
L 7527
L 7528
L 7529
L 7540
L 7550
L 7589
L 7590
L 7592
N 7540
N 7541
R 7202
R 7501
R 7503
R 7522
R 7528
R 7530
R 7541
T 7502
T 7580
Z 7503
Z 7521
Z 7540
Z 7580
Z 7582
E1001
X2400
N7520
N7505
C2070
B2102
E1000
A7500

Auto tuning for BB5.0

This phone can be tuned automatically.

Autotune is designed to align the phone's RF part easier and faster. It performs calibrations, tunings and measurements of RX and TX. The results are displayed and logged in a result file, if initiated.

Hardware set up

Hardware requirements for auto tuning:

- PC (Windows 2000/XP) with GPIB card
- Power supply
- Product specific module jig
- Cables: XRF-1 (RF cable), USB cable, GBIP cable and DAU-9S
- Signal analyser (TX), signal generator (RX) and RF-splitter *or* one device including all.

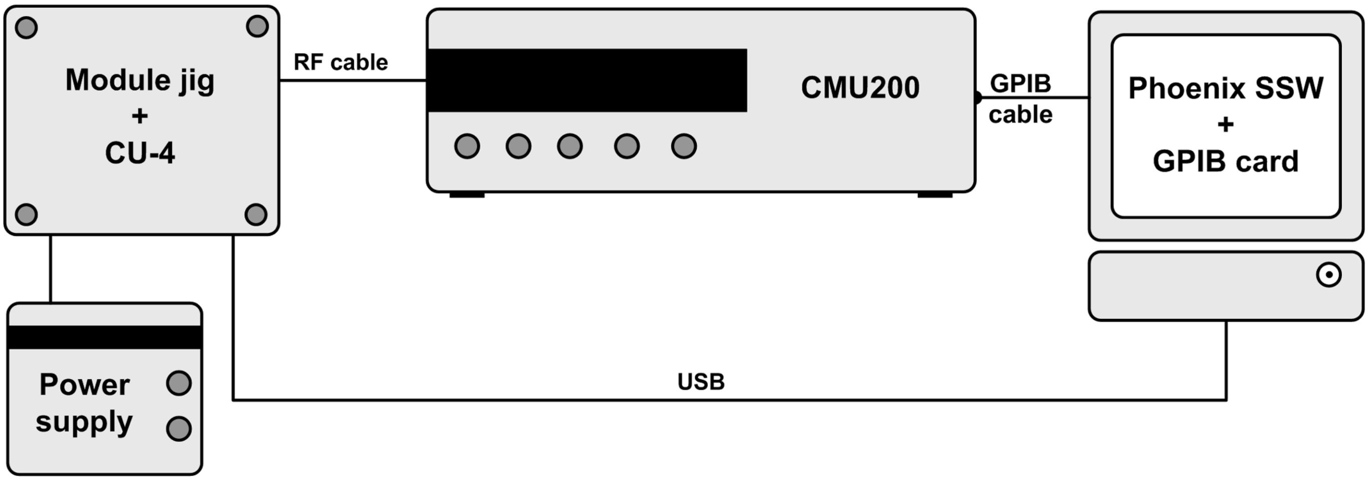


Figure 14 Auto tuning concept with CMU200

Note: Crossover Cable connection between computer and CU200 is recommended (refer to Service Devices chapter and Module Jig concept).

Phoenix preparations

Install the phone specific data package, for example *RM-210_dp_1.78_sw_sh3.26.exe*. This defines phone specific settings..

Auto tuning procedure

1 Make sure the phone (in the jig) is connected to the equipment. Else, some menus will not be shown in Phoenix.

2 To go to autotune, select *Tuning (Alt-U)* > *Auto-Tune (Alt-A)* from the menu.

3 Start autotuning, clicking the *Tune* button.

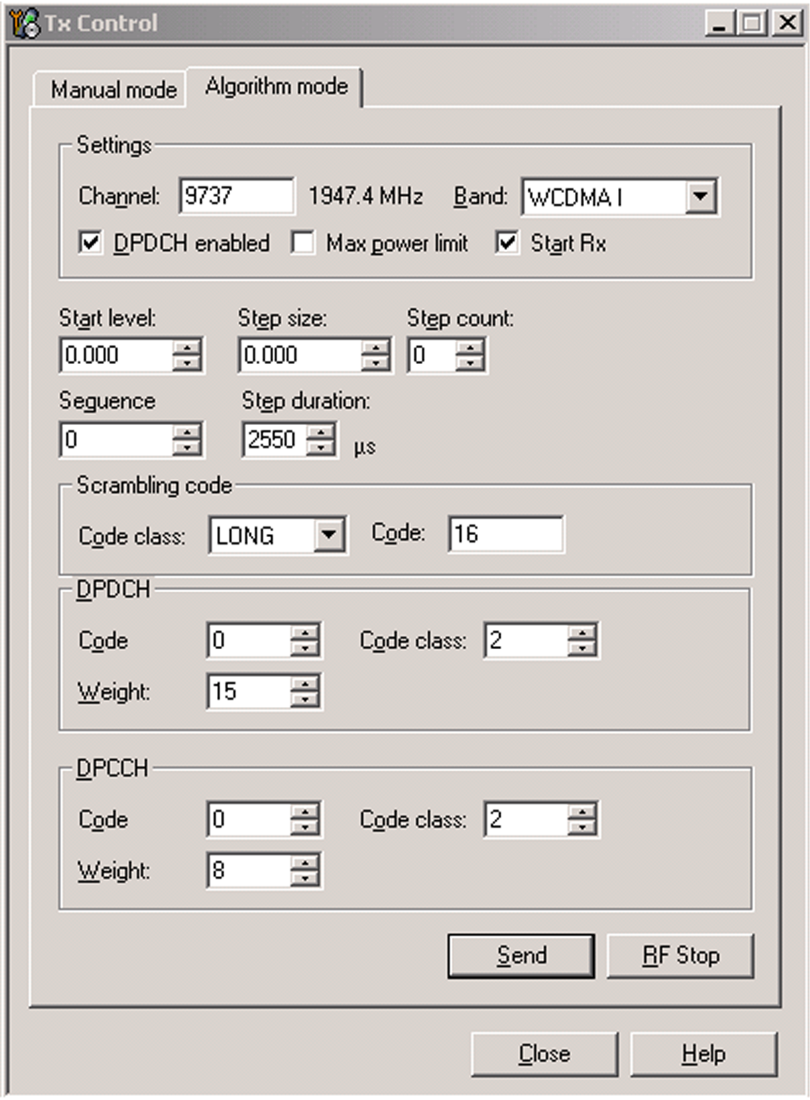
General voltage checking

Steps

1. Set up the main board in the module jig. The phone should be in local mode.
2. Check the following:

#	Signal name	Test point	Voltage (all bands)
1	VCTCXO supply	R7501	2.5 V
2	AHNEUS supply from DC/DC conv	C7590	3.1 V
3	FEM supply	C7523	3.9 V
4	WCDMA PA supply from DC/DC conv	C7543	0 V (1.3 V* when transmitting. Settings as in note below)
5	Vbat at WCDMA PA	C7547	3.9 V
6	Supply input to DC/DC conv	L7591	3.9 V

* With these settings, the result should be 1.3 V.


Tx Control
Manual mode
Algorithm mode
Send
RF Stop
Close
Help

Settings

Channel: 9737 1947.4 MHz Band: WCDMA I

☑ DPDCH enabled ☐ Max power limit ☑ Start Rx

Start level: 0.000

Step size: 0.000

Step count: 0

Sequence: 0

Step duration: 2550 µs

Scrambling code

Code class: LONG

Code: 16

DPDCH

Code: 0

Code class: 2

Weight: 15

DPCCH

Code: 0

Code class: 2

Weight: 8

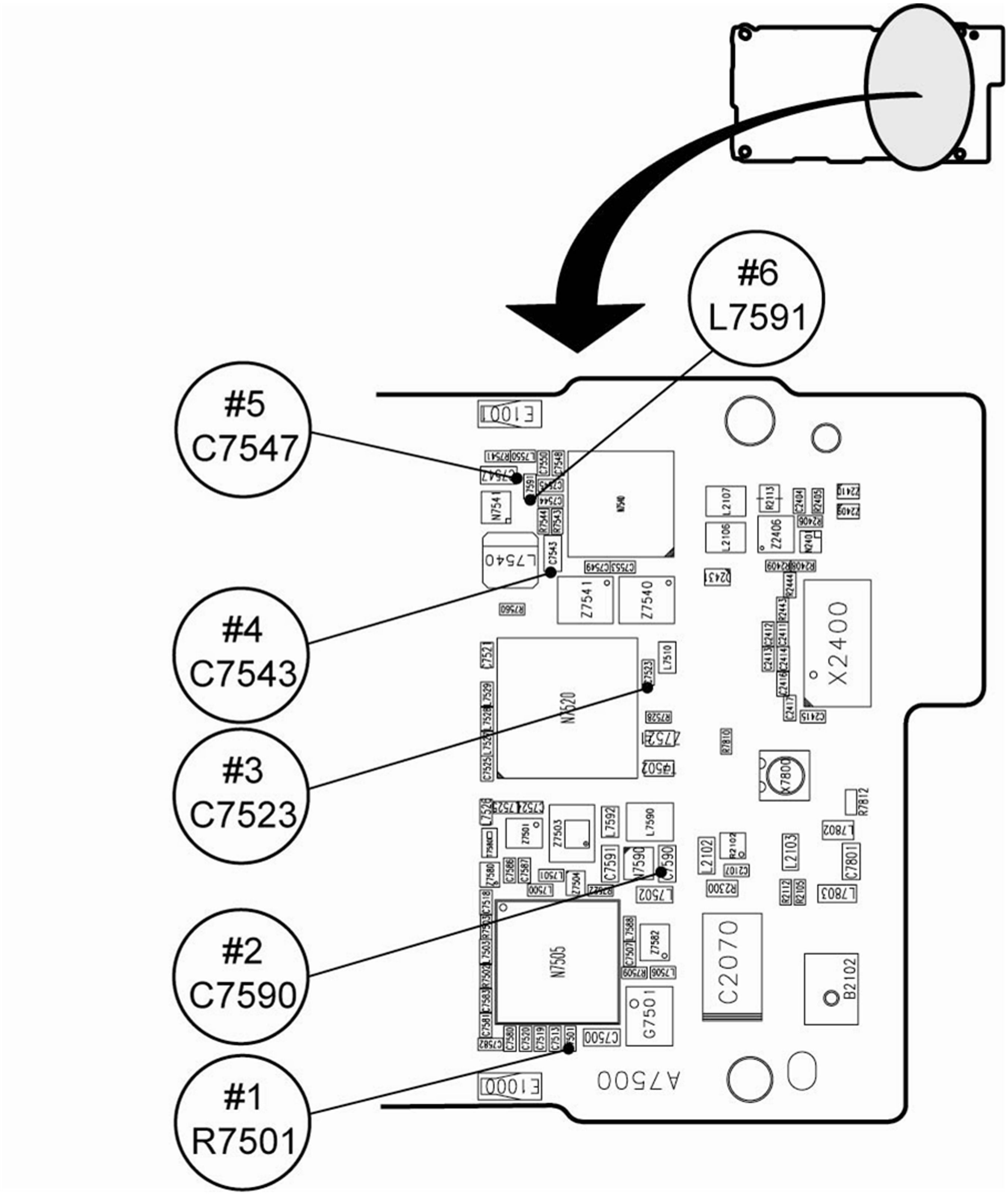

#6
L7591
#5
C7547
#4
C7543
#3
C7523
#2
C7590
#1
R7501
E1001
L7540
Z7541
Z7540
X2400
N7520
X7800
C2070
B2102
N7505
G7501
A7500
E1000

Figure 15 General voltage checking test points (main board, top side)

Receiver troubleshooting

Introduction to receiver (RX) troubleshooting

RX can be tested by making a phone call or in local mode. For the local mode testing, use Phoenix service software.

The main RX troubleshooting measurement is RSSI reading. This test measures the signal strength of the received signal. For GSM RSSI measurements, see *GSM RX chain activation for manual measurements/GSM RSSI measurement*. For a similar test in WCDMA mode, see *WCDMA RSSI measurement*.

GSM RX chain activation for manual measurements/GSM RSSI measurement

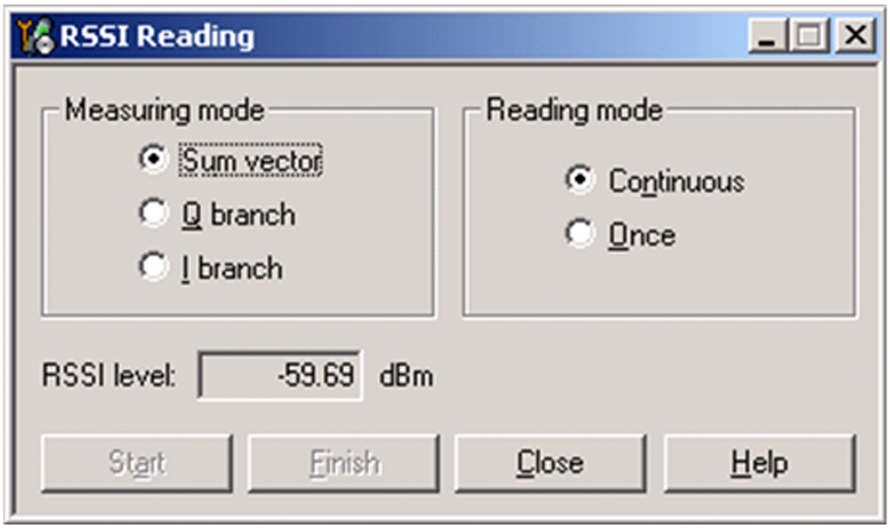
Prerequisites

Make the following settings in Phoenix service software and in the signal generator:

Setting	GSM850	GSM900	GSM1800	GSM1900
Phoenix Channel	190	37	700	661
Signal generator to antenna connector	881.66771 MHz (67.71kHz offset) at -60dBm	942.46771 MHz (67.71kHz offset) at -60dBm	1842.86771 MHz (67.71kHz offset) at -60dBm	1960.046771 MHz (67.71kHz offset) at -60dBm

Steps

1. Set the phone to local mode.
2. Activate RSSI reading in Phoenix (**Testing→GSM→RSSI reading**)



Measuring mode
● Sum vector
○ Q branch
○ I branch

Reading mode
● Continuous
○ Once

RSSI level: -59.69 dBm

Results

With the *Measuring mode* set to *Sum vector*, the reading should reflect the level of the signal generator (-losses) +/- 5 dB.

When varying the level in the range -30 to -102 dBm the reading should then follow within +/-5 dB.

Now select the measuring mode to *Q branch* and *I Branch*. In each case the reading should be 3 dB below the signal generator level.

WCDMA RX chain activation for manual measurement/WCDMA RSSI measurement

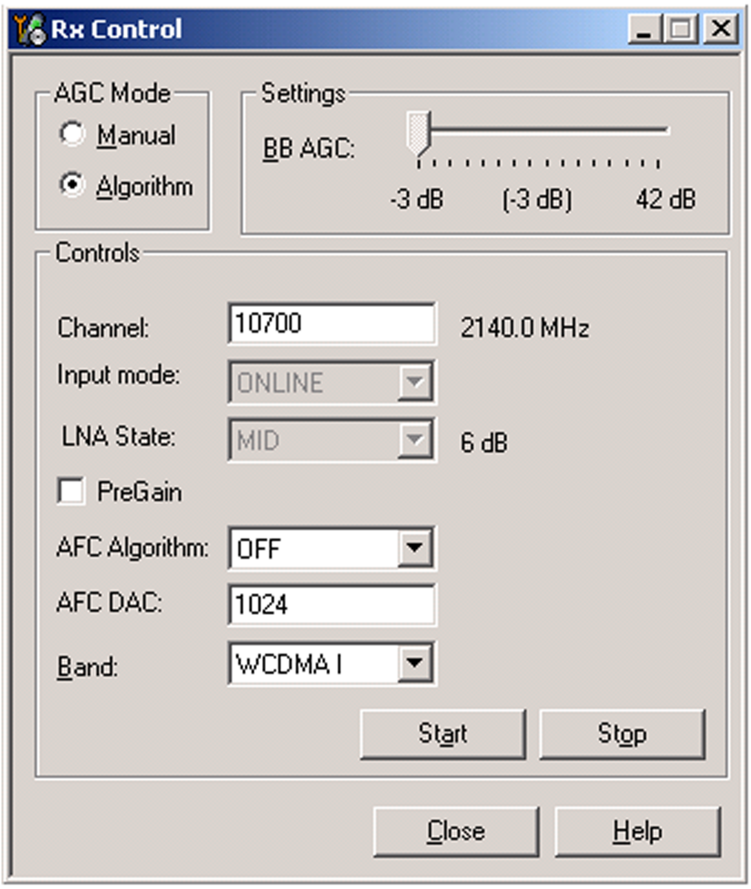
Prerequisites

Make the following settings in Phoenix service software and in the signal generator.

Setting	Band I	Band V
Phoenix channel	10700	4407
Signal generator to antenna connector	21400 MHz	881.4 MHz

Steps

1. Via Phoenix Testing menu, choose **WCDMA/RX Control**.
2. In the RX control window, make the following settings:



AGC Mode: ○ Manual ● Algorithm

BB AGC: -3 dB (-3 dB) 42 dB

Channel: 10700 2140.0 MHz

Input mode: ONLINE

LNA State: MID 6 dB

☐ PreGain

AFC Algorithm: OFF

AFC DAC: 1024

Band: WCDMA I

Figure 16 RX Control window with example settings

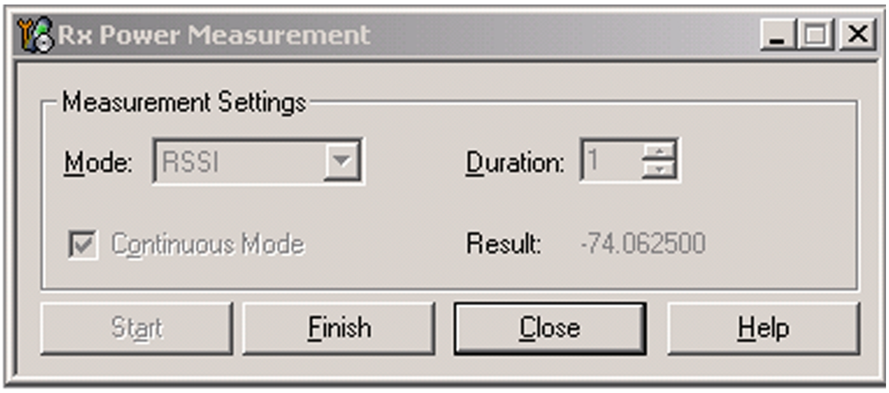
3. Click **Start** to activate the settings.

   If the settings are changed later on (for example, change of channel) you have to click **Stop** and **Start** again.

   Note: Clicking **Stop** also disables TX control if it was active.

4. From the Phoenix testing menu, select **WCDMA→RX Power measurement**
5. In the RX Power measurement window, select:
   - Mode: RSSI

- Continuous mode



Rx Power Measurement

Measurement Settings

Mode: RSSI

Duration: 1

☑ Continuous Mode

Result: -74.062500

6. Click **Start** to perform the measurement.

Results

The reading should reflect the level of the signal generator (-losses) ± 5 dB.

Transmitter troubleshooting

General instructions for transmitter (TX) troubleshooting

Please note the following before performing transmitter tests:

- TX troubleshooting requires TX operation.
- Do not transmit on frequencies that are in use!
- The transmitter can be controlled in local mode for diagnostic purposes.
- The most useful Phoenix tool for GSM transmitter testing is “RF Controls”; in WCDMA transmitter testing the best tool is “TX Control”.
- Remember that re-tuning is not a fix! Phones are tuned correctly in production

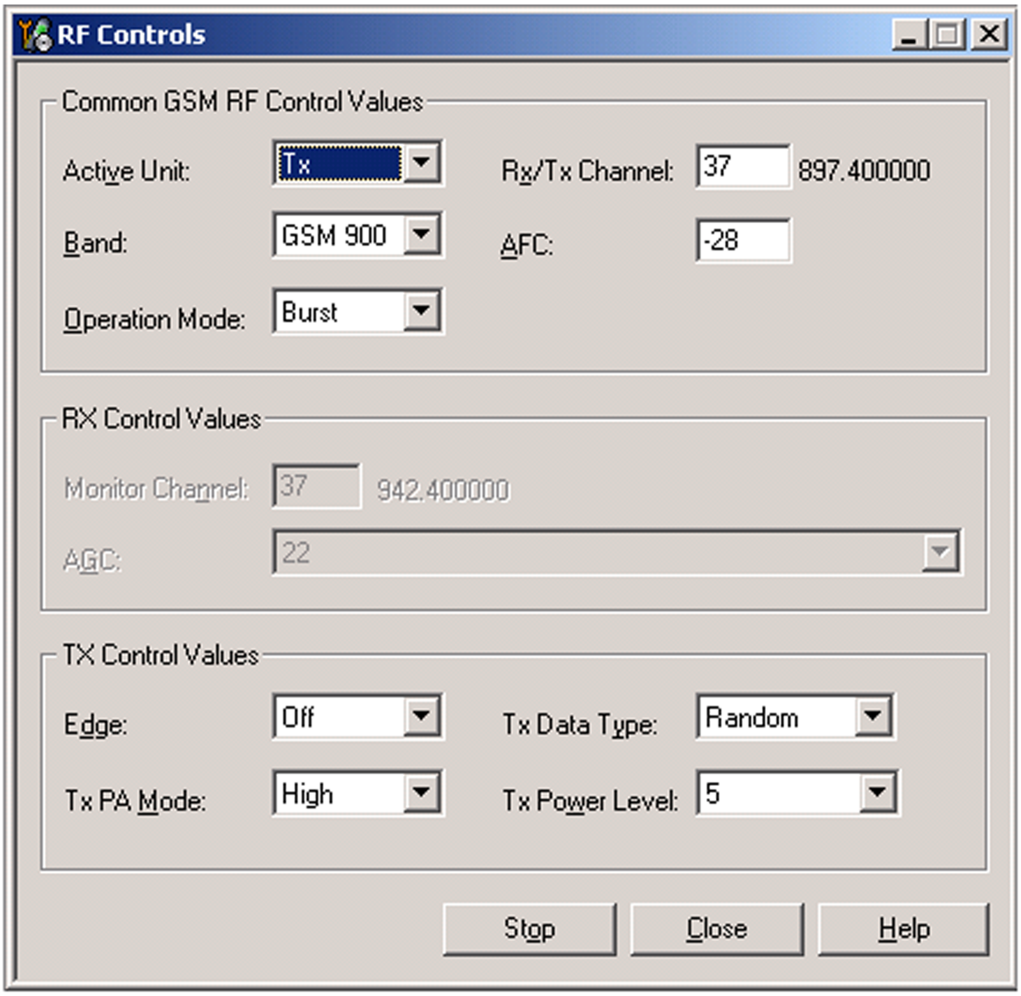
Note: Never activate the GSM or WCDMA transmitter without a proper antenna load. Always connect a 50 Ω load to the RF connector (antenna, RF-measurement equipment or at least a 2 W dummy load); otherwise the GSM or WCDMA Power amplifier (PA) may be damaged.

GSM transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. Activate RF controls in Phoenix (**Testing→GSM→Rf Controls**).

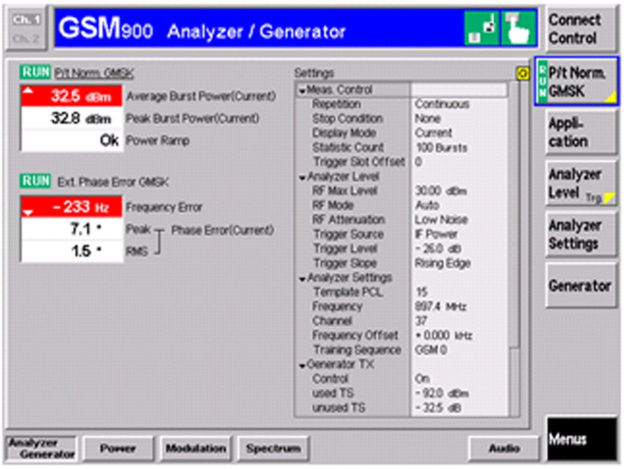
   Make settings as shown in the picture:


RF Controls
Common GSM RF Control Values
RX Control Values
TX Control Values
Stop
Close
Help

Active Unit: Tx
Band: GSM 900
Operation Mode: Burst
Rx/Tx Channel: 37 897.400000
AFC: -28
Monitor Channel: 37 942.400000
AGC: 22
Edge: Off
Tx PA Mode: High
Tx Data Type: Random
Tx Power Level: 5

3. Check the basic TX parameters (i.e. power, phase error, modulation and switching spectrum), using a communication analyser (for example CMU200).

Analyser settings


Ch. 1
Ch. 2
GSM900 Analyzer / Generator
Connect Control
P/t Norm. GMSK
Appli-cation
Analyzer Level Trg
Analyzer Settings
Generator
Menus
Analyzer Generator
Power
Modulation
Spectrum
Audio

RUN P/t Norm. GMSK

32.5 dBm	Average Burst Power(Current)
32.8 dBm	Peak Burst Power(Current)
Ok	Power Ramp

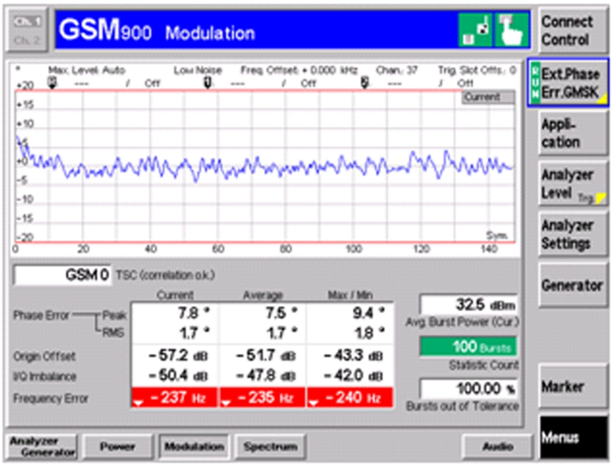
RUN Ext. Phase Error GMSK

- 233 Hz	Frequency Error
7.1 °	Peak – Phase Error(Current)
1.5 °	RMS

Settings

Meas. Control	
Repetition	Continuous
Stop Condition	None
Display Mode	Current
Statistic Count	100 Bursts
Trigger Slot Offset	0
Analyzer Level	
RF Max Level	30.00 dBm
RF Mode	Auto
RF Attenuation	Low Noise
Trigger Source	IF Power
Trigger Level	- 26.0 dB
Trigger Slope	Rising Edge
Analyzer Settings	
Template PCL	15
Frequency	897.4 MHz
Channel	37
Frequency Offset	+ 0.000 kHz
Training Sequence	GSM 0
Generator TX	
Control	On
used TS	- 92.0 dBm
unused TS	- 32.5 dB

Phase error


Ch. 1
Ch. 2
GSM900 Modulation
Connect Control
Ext.Phase Err.GMSK
Appli-cation
Analyzer Level Trg
Analyzer Settings
Generator
Marker
Menus
Max. Level: Auto
Low Noise
Freq. Offset: + 0.000 kHz
Chan.: 37
Trig. Slot Offs.: 0
Off
Current
+20
+15
+10
+5
+0
-5
-10
-15
-20
Sym.
0
20
40
60
80
100
120
140
Analyzer Generator
Power
Modulation
Spectrum
Audio

GSM 0 TSC (correlation o.k.)

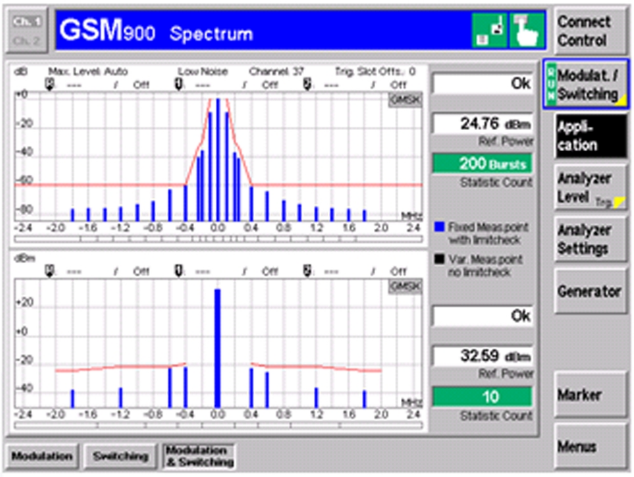
		Current	Average	Max / Min
Phase Error	Peak	7.8 °	7.5 °	9.4 °
	RMS	1.7 °	1.7 °	1.8 °
Origin Offset		- 57.2 dB	- 51.7 dB	- 43.3 dB
I/Q Imbalance		- 50.4 dB	- 47.8 dB	- 42.0 dB
Frequency Error		- 237 Hz	- 235 Hz	- 240 Hz

32.5 dBm Avg. Burst Power (Cur.)

100 Bursts Statistic Count

100.00 % Bursts out of Tolerance

Modulation/Switching spectrum


Ch. 1
Ch. 2
GSM900 Spectrum
Connect Control
Modulat. / Switching
Appli-cation
Analyzer Level Trg
Analyzer Settings
Generator
Marker
Menus
dB
Max. Level: Auto
Low Noise
Channel: 37
Trig. Slot Offs.: 0
Off
GMSK
+0
-20
-40
-60
-80
MHz
-2.4
-2.0
-1.6
-1.2
-0.8
-0.4
0.0
0.4
0.8
1.2
1.6
2.0
2.4
dBm
+20
+0
-20
-40
Fixed Meas.point with limitcheck
Var. Meas.point no limitcheck
Modulation
Switching
Modulation & Switching

Ok

24.76 dBm Ref. Power

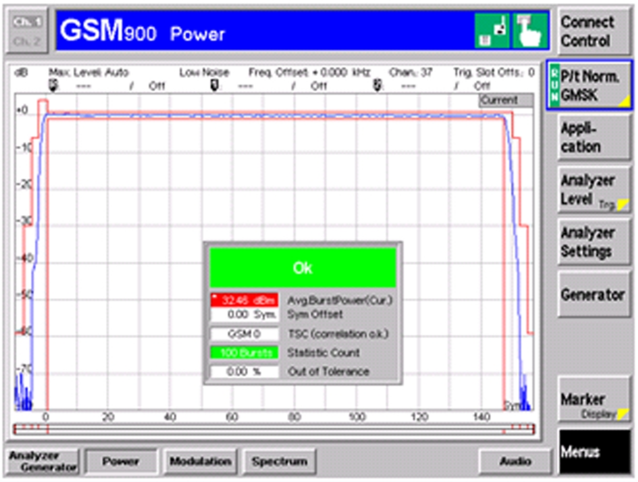
200 Bursts Statistic Count

Ok

32.59 dBm Ref. Power

10 Statistic Count

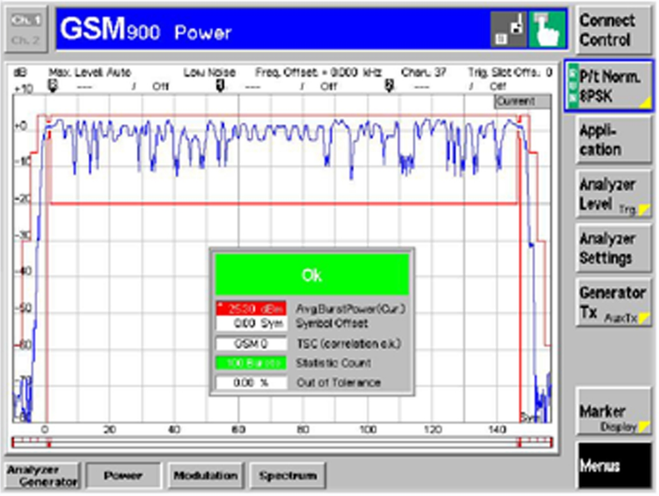
Power/Burst


Ch. 1
Ch. 2
GSM900 Power
Connect Control
P/t Norm. GMSK
Appli-cation
Analyzer Level Trg
Analyzer Settings
Generator
Marker Display
Menus
dB
Max. Level: Auto
Low Noise
Freq. Offset: + 0.000 kHz
Chan.: 37
Trig. Slot Offs.: 0
Off
Current
+0
-10
-20
-30
-40
-50
-60
-70
Sym.
0
20
40
60
80
100
120
140
Analyzer Generator
Power
Modulation
Spectrum
Audio

Ok

32.46 dBm	Avg.BurstPower(Cur.)
0.00 Sym.	Sym.Offset
GSM 0	TSC (correlation o.k.)
100 Bursts	Statistic Count
0.00 %	Out of Tolerance

Edge


Ch. 1
Ch. 2
GSM900 Power
Connect Control
P/t Norm. 8PSK
Appli-cation
Analyzer Level Trg
Analyzer Settings
Generator Tx AuxTx
Marker Display
Menus
dB
Max. Level: Auto
Low Noise
Freq. Offset: + 0.000 kHz
Chan.: 37
Trig. Slot Offs.: 0
Off
Current
+10
+0
-10
-20
-30
-40
-50
-60
-70
Sym
0
20
40
60
80
100
120
140
Analyzer Generator
Power
Modulation
Spectrum

Ok

25.30 dBm	AvgBurstPower(Cur.)
0.00 Sym	Symbol Offset
GSM 0	TSC (correlation o.k.)
100 Bursts	Statistic Count
0.00 %	Out of Tolerance

Figure 17 Typical readings

4. Change power level (RF controls) and make sure the power reading follows accordingly.

Next actions

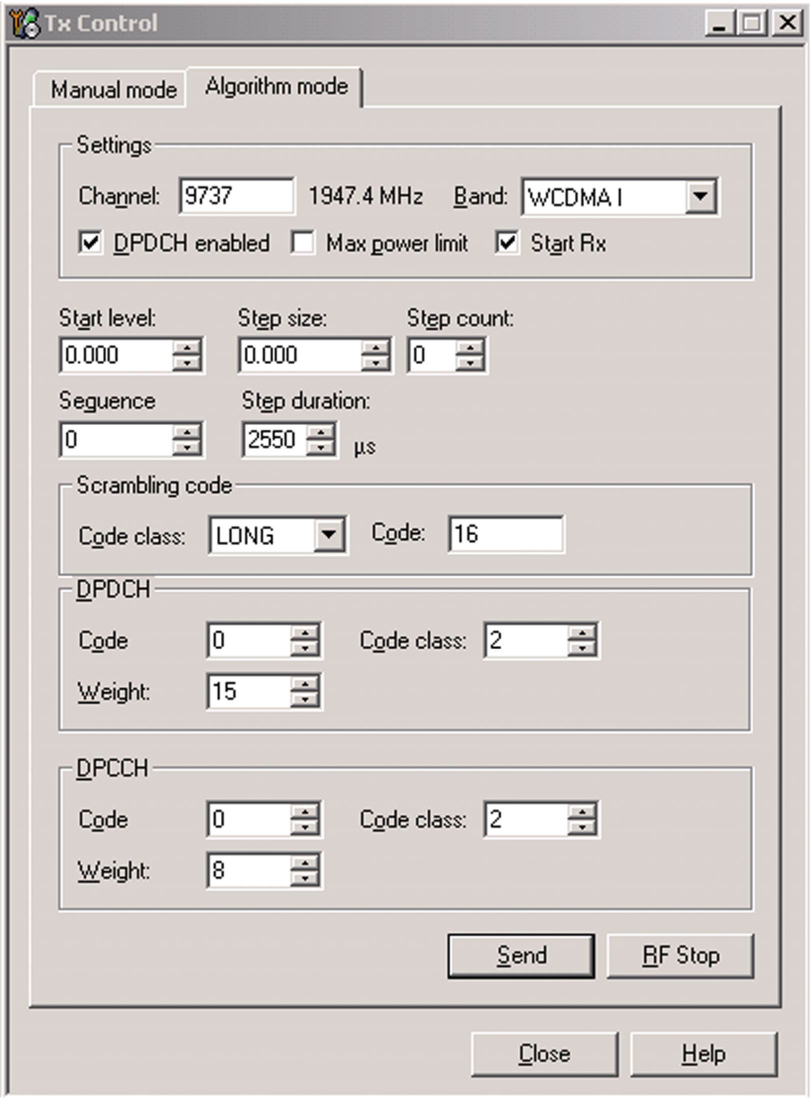
If you want to troubleshoot the other bands, change band with RF controls and set the communication analyser accordingly.

WCDMA transmitter troubleshooting

Steps

1. Set the phone to local mode.
2. In Phoenix, select **Testing→WCDMA→TX control** .
3. In the TX control window, make settings as shown in the picture:

   Note: *Star level* is the expected power out.



Settings

Channel: 9737 1947.4 MHz Band: WCDMA I

☑ DPDCH enabled ☐ Max power limit ☑ Start Rx

Start level: 0.000 Step size: 0.000 Step count: 0

Sequence 0 Step duration: 2550 µs

Scrambling code

Code class: LONG Code: 16

DPDCH

Code 0 Code class: 2

Weight: 15

DPCCH

Code 0 Code class: 2

Weight: 8

4. Click **Send** to enable the settings and activate TX.

   If settings are changed (eg. new channel), you have to click **RF Stop** and **Send** again.
5. Check the basic TX parameters (i.e. power and EVM) using a communication analyser (eg. CMU200).
6. To repeat the test for other bands, select the correct band in the TX control and repeat the measurements.

Bluetooth and FM radio troubleshooting

Bluetooth troubleshooting

Troubleshooting flow

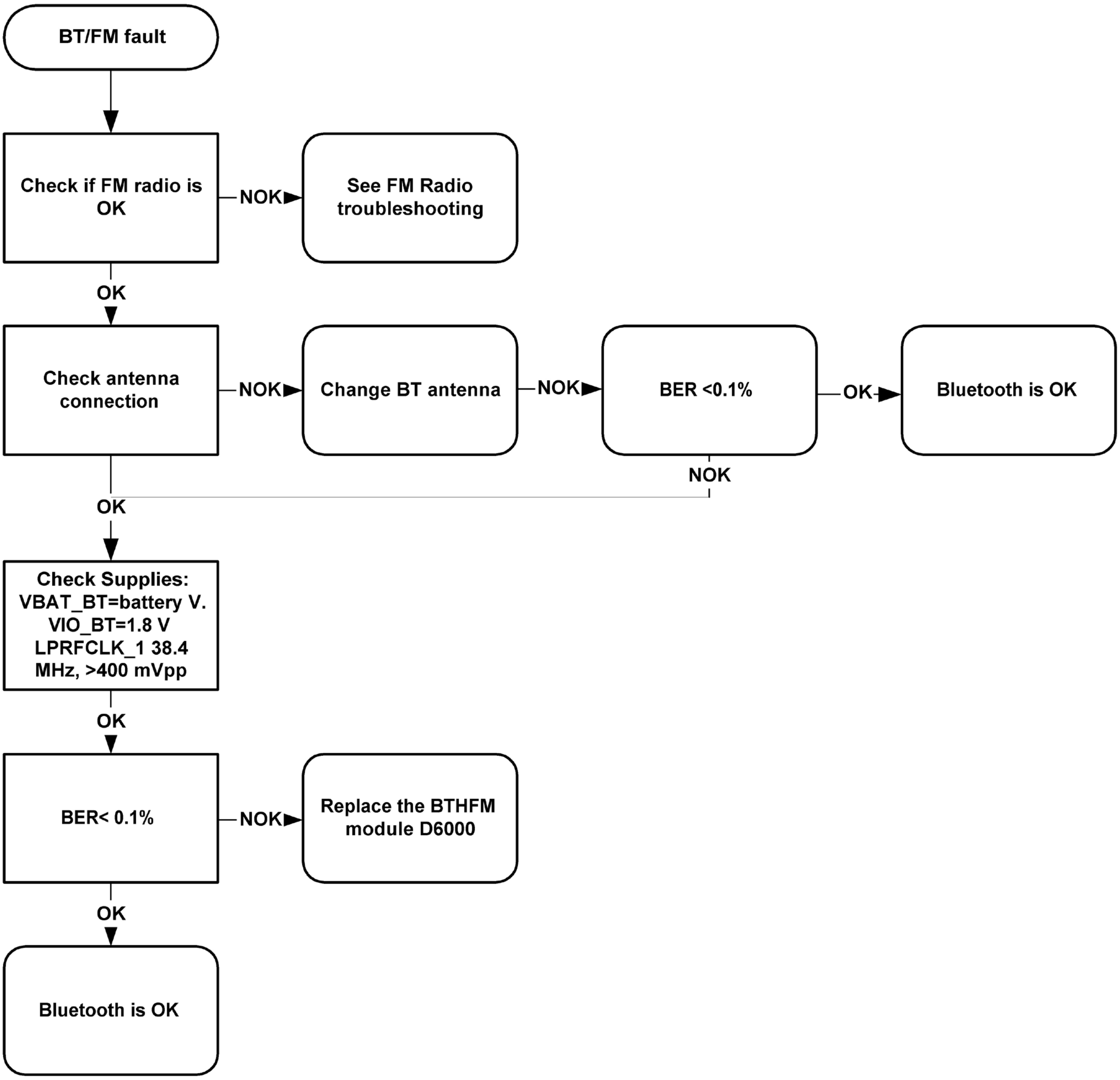
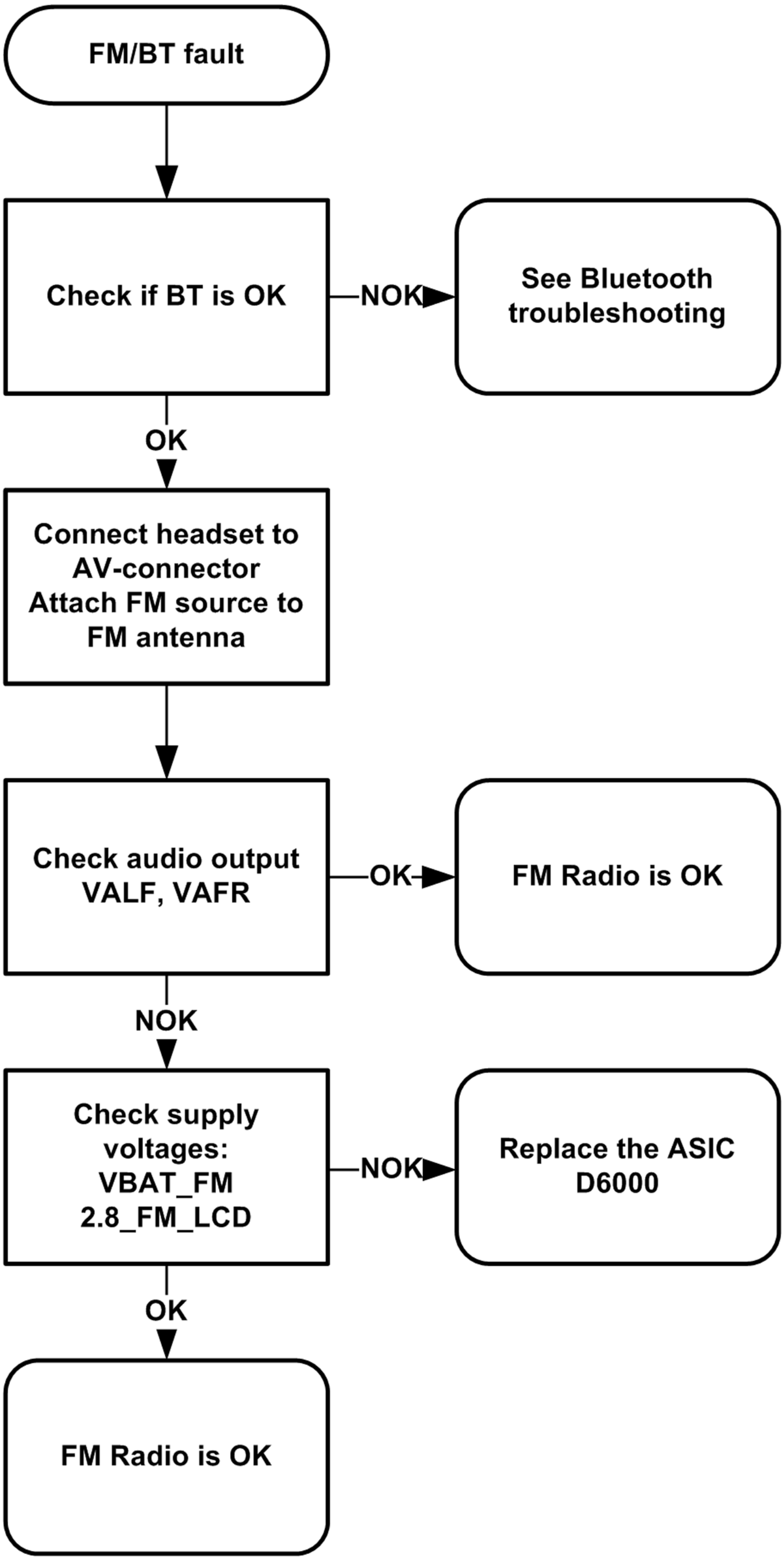

BT/FM fault
Check if FM radio is OK
NOK
See FM Radio troubleshooting
OK
Check antenna connection
NOK
Change BT antenna
NOK
BER <0.1%
OK
Bluetooth is OK
NOK
OK
Check Supplies: VBAT_BT=battery V. VIO_BT=1.8 V LPRFCLK_1 38.4 MHz, >400 mVpp
OK
BER< 0.1%
NOK
Replace the BTHFM module D6000
OK
Bluetooth is OK

Figure 18 Troubleshooting diagram: Bluetooth

FM radio troubleshooting

Troubleshooting flow


FM/BT fault
Check if BT is OK
NOK
See Bluetooth troubleshooting
OK
Connect headset to AV-connector Attach FM source to FM antenna
Check audio output VALF, VAFR
OK
FM Radio is OK
NOK
Check supply voltages: VBAT_FM 2.8_FM_LCD
NOK
Replace the ASIC D6000
OK
FM Radio is OK

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5 — System Module

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Introduction

Phone description

RAP is the main digital baseband ASIC in the phone. It contains functionality for both WCDMA and GSM EDGE. The hardware accelerator is used as a camera accelerator.

N2200 (AVILMA) is mainly the audio ASIC in the phone and N2300 (BETTY) is basically the energy management controller for the phone.

Bluetooth and FM radio are physically integrated in one single ASIC.

RM-240 operates on bands GSM850/900/1800/1900 and WCDMA band I & V.

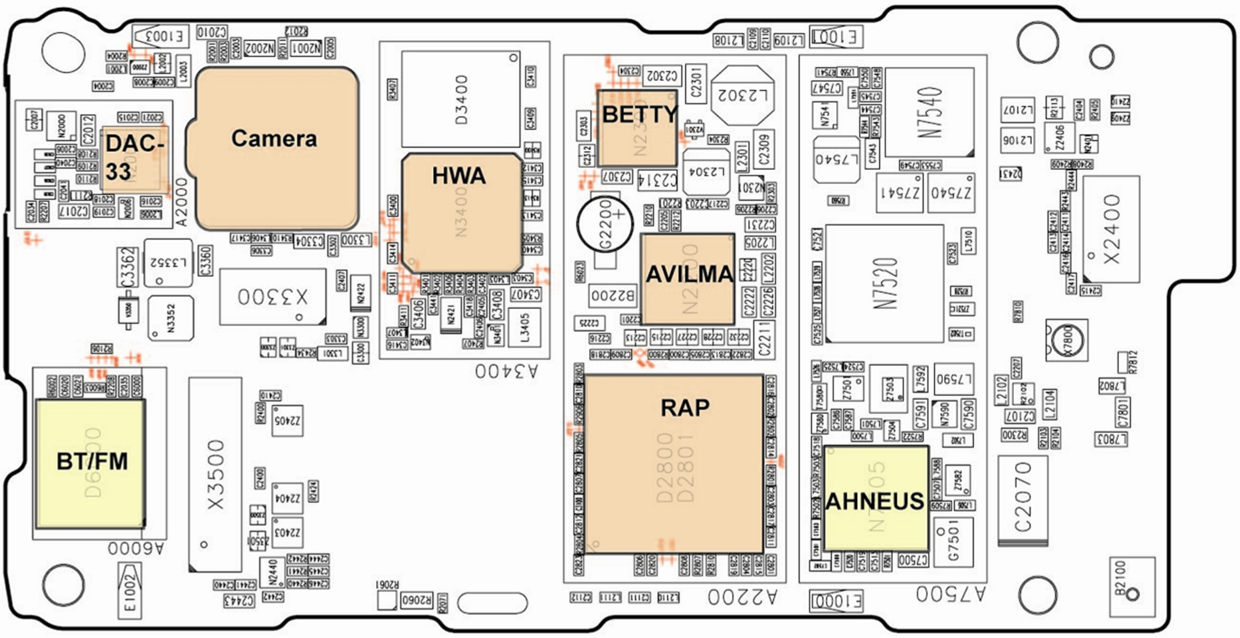
Key components

Function	Description	Item ref
Main board	2ama_a	
Top board	2amb	
Bottom flex	2amc	
Top board	2amf	
Camera flex	2amg	
Camera flash PWB	2amh	
Energy management ASIC	AVILMA BETTY	N2200 N2300
RF ASIC	Ahneus	N7505
Processor	RAP3GS (Stacked with memory)	D2800
Hardware (camera) accelerator	Julie	N3400
PA GSM	Front end module (FEM), quad band	N7520
PA WCDMA	Triple band PA	N7540
Oscillators	VCTCXO	G7501
Memory	512 Mbit NOR + 256 Mbit DRAM Combo (Stacked with RAP)	D2801
Back-up battery	RTC back-up battery 311	G2200
FM radio	BTHFMRDS2.0 module	D6000
Bluetooth	BTHFMRDS2.0 module	D6000
Slide switch	Hall IC switch/position sensor	N2421, N2422
Battery	BP-5M	
Battery connector	Blade interface	X2070
Ambient light sensor (ALS)		N2500
TV out	TV out graphics engine	D2430
Earpiece		B2170

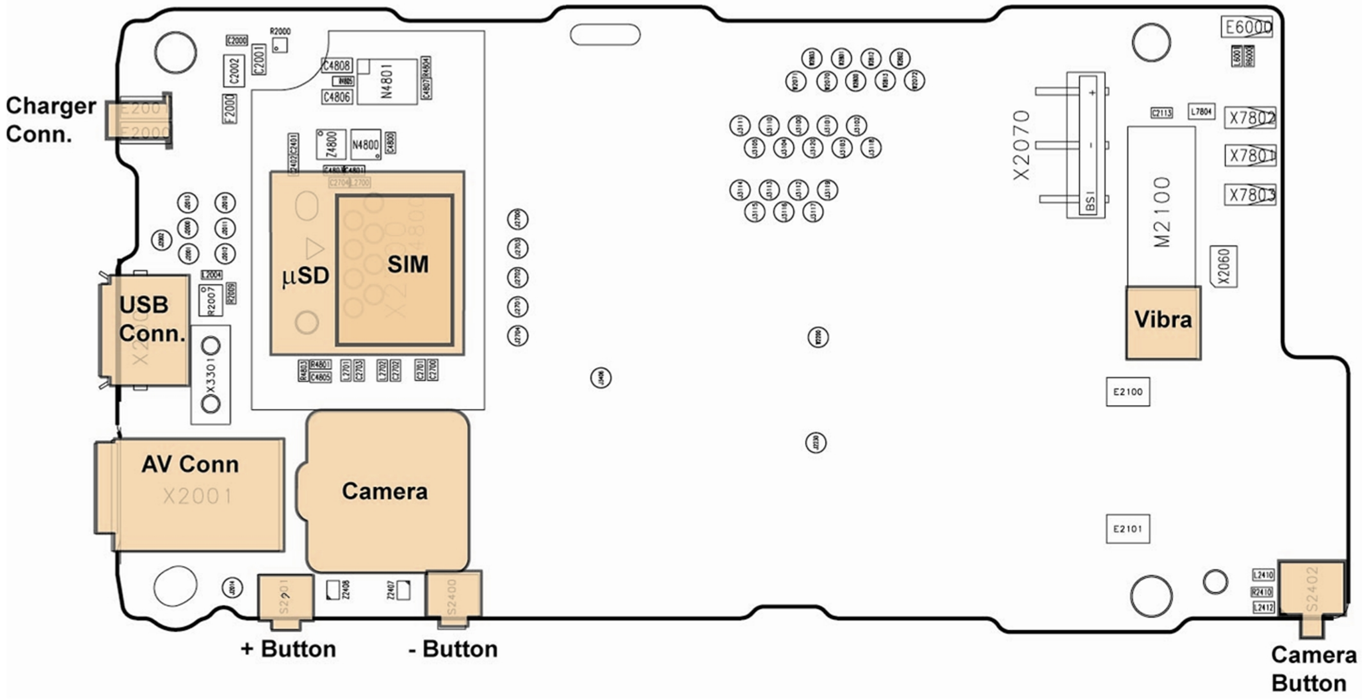
Function	Description	Item ref
Secondary camera	VGA	N3550
Microphone	Knopfler, digital interface	B2102
µSD card connector		X4800
AV connector	2.5 mm	X2001
µUSB connector		X2002

Key component placement

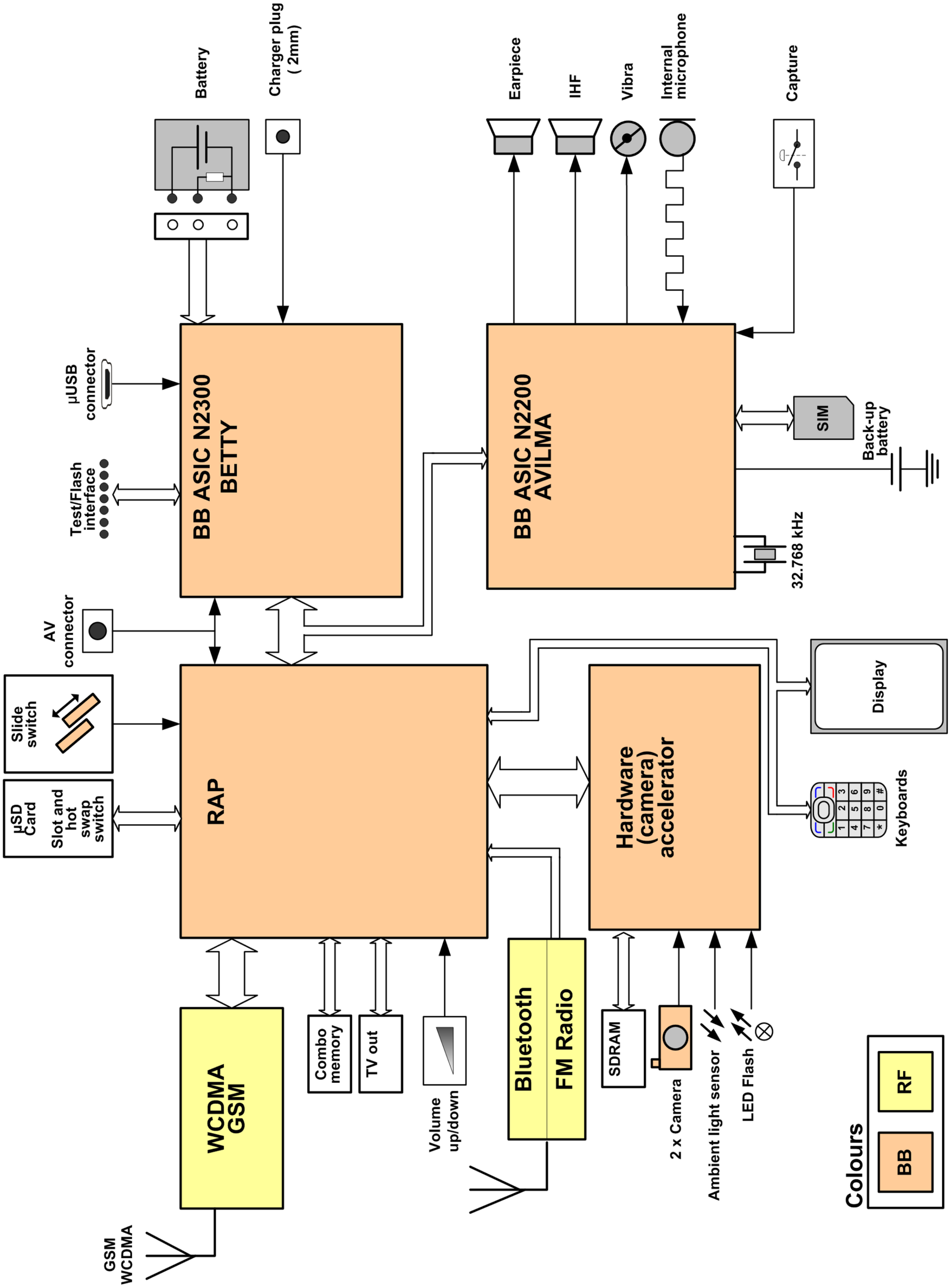
Top Side


Camera
DAC-33
HWA
BETTY
AVILMA
RAP
AHNEUS
BT/FM
D3400
X3300
X3500
N7540
N7520
X2400
C2070
G2200
B2200
A2000
A3400
A2200
A7500
A6000
E1003
E1001
E1002
B2100

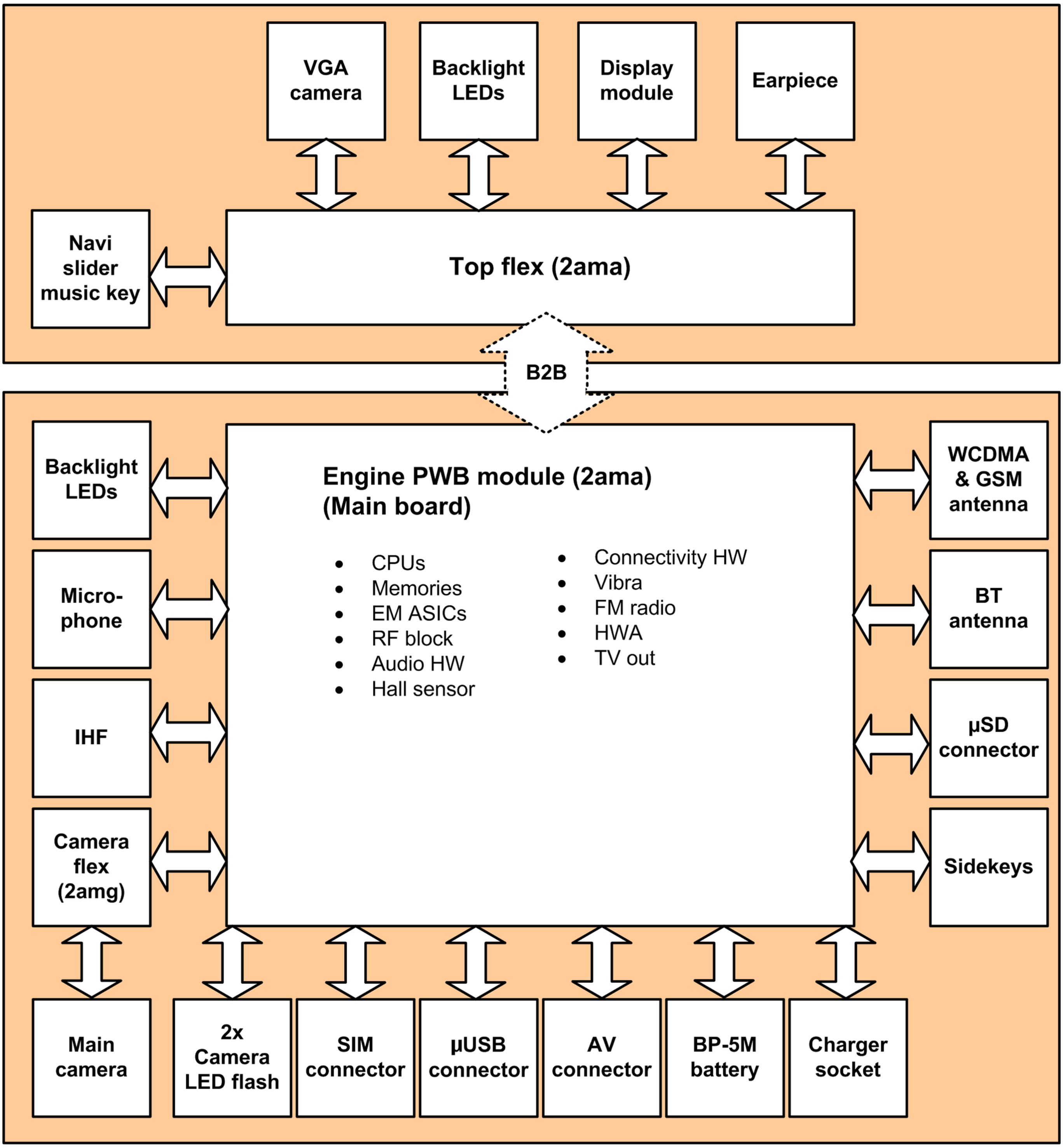
Bottom Side


Charger Conn.
USB Conn.
AV Conn
X2001
µSD
SIM
N4801
N4800
Camera
Vibra
M2100
X2070
BSI
X7802
X7801
X7803
X2060
E6000
E2100
E2101
+ Button
- Button
Camera Button

System module block diagram


Battery
Charger plug (2mm)
Earpiece
IHF
Vibra
Internal microphone
Capture
µUSB connector
Test/Flash interface
BB ASIC N2300 BETTY
BB ASIC N2200 AVILMA
SIM
Back-up battery
32.768 kHz
AV connector
Slide switch
µSD Card Slot and hot swap switch
RAP
Hardware (camera) accelerator
Display
Keyboards
WCDMA GSM
Combo memory
TV out
Volume up/down
Bluetooth
FM Radio
SDRAM
2 x Camera
Ambient light sensor
LED Flash
GSM WCDMA
Colours
BB
RF

Board and module connections


VGA camera
Backlight LEDs
Display module
Earpiece
Navi slider music key
Top flex (2ama)
B2B
Backlight LEDs
Micro-phone
IHF
Camera flex (2amg)
Engine PWB module (2ama) (Main board)
CPUs
Memories
EM ASICs
RF block
Audio HW
Hall sensor
Connectivity HW
Vibra
FM radio
HWA
TV out
WCDMA & GSM antenna
BT antenna
µSD connector
Sidekeys
Main camera
2x Camera LED flash
SIM connector
µUSB connector
AV connector
BP-5M battery
Charger socket

Energy management

Battery and charging

BP-5M battery

The phone is powered by a 3-pole BP-5M S-pack 900 mAh battery. The three poles are named VBAT, BSI and GND where the BSI line is used to recognize the battery capacity. This is done by means of an internal battery pull down resistor.

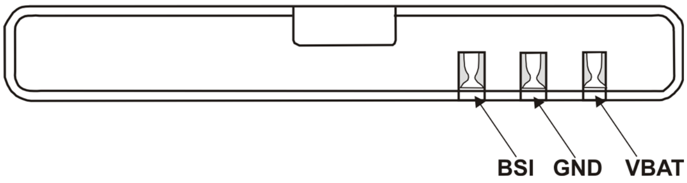


Figure 19 Battery pin order

The battery temperature is estimated by measuring separate battery temperature NTC via the BTEMP line. This is located on the main PWB, at the place where the phone temperature is closest to the battery temperature.

Battery connector

The battery connector is a blade connector. It has three blades;

- BSI (Battery size indicator)
- GND (Ground)
- VBAT (Battery voltage)

The BSI line is used to recognize the battery capacity by a battery internal pull down resistor.

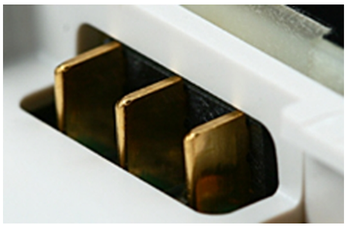


Figure 20 Blade battery connector

Charging

This phone is charged through the smaller Nokia standard interface (2.0 mm plug). The wider standard charger (3.5 mm) can be used together with the CA-44 charger adapter.

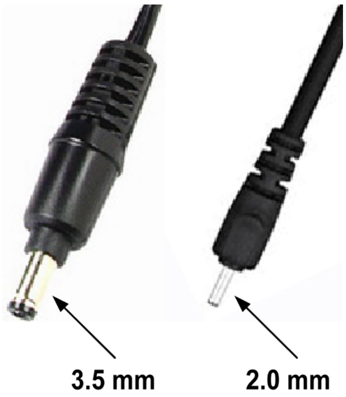


Figure 21 Small (left) and wide (right) charger plugs

Charging is controlled by energy management, and external components are needed to protect the baseband module against EMC, reverse polarity and transient frequency deviation.

Normal and extreme voltages

Energy management is mainly carried out in the two Application Specific Integrated Circuits (ASICs) N2300 BETTY and N2200 AVILMA. These two circuits contains a number of regulators. In addition there are some external regulators too.

In the table below normal and extreme voltages are shown when a BP-5M S-pack battery is used.

Table 7 Nominal voltages

Voltage	Voltage [V]	Condition
General Conditions		
Nominal voltage	3.700	
Lower extreme voltage	3.145	
Higher extreme voltage	4.230	
(fast charging)		
HW Shutdown Voltages		
Vmstr+	2.1 ± 0.1	Off to on
Vmstr-	1.9 ± 0.1	On to off
SW Shutdown Voltages		
Sw shutdown	3.1	In call
Sw shutdown	3.2	In idle
Min Operating Voltage		
Vcoff+	2.9 ± 0.1	Off to on
Vcoff-	2.6 ± 0.1	On to off

Power key and system power-up

When the battery is placed in the phone the power key circuits are energized (the phone doesn't have a dedicated power key but the end call key is used). When the end call key is pressed, the system boots up (if an adequate battery voltage is present).

Power down can be initiated by pressing the power key again (the system is powered down with the aid of SW). The power key is connected to EM ASIC N2200 (AVILMA) via PWRONX signal.

Modes of operation

Mode	Description
NO_SUPPLY	(dead) mode means that the main battery is not present or its voltage is too low (below N2200 AVILMA master reset threshold) and that the back-up battery voltage is too low.
BACK_UP	The main battery is not present or its voltage is too low but back-up battery voltage is adequate and the 32 kHz oscillator is running (RTC is on).
PWR_OFF	In this mode (warm), the main battery is present and its voltage is over N2300 BETTY master reset threshold. All regulators are disabled, PurX is on low state, the RTC is on and the oscillator is on. PWR_OFF (cold) mode is almost the same as PWR_OFF (warm), but the RTC and the oscillator are off.
RESET	RESET mode is a synonym for start-up sequence. RESET mode uses 32 kHz clock to count the REST mode delay (typically 16ms).
SLEEP	SLEEP mode is entered only from PWR_ON mode with the aid of SW when the system's activity is low.
FLASHING	FLASHING mode is for SW downloading.

Clocking scheme

In BB5.0, two main clocks are provided to the system: 38.4MHz RF clock produced by VCTCXO in RF section and 32.768kHz sleep clock produced by EM ASIC N2200 with an external crystal.

32 k Sleep Clock is always powered on after startup. Sleep clock is used by RAP for low-power operation.

SMPS Clk is 2.4 MHz clock line from RAP to EM ASIC N2300. In deep sleep mode, when VCTCXO is off, this signal is set to '0'-state.

BT Clk is 38.4 MHz signal from Ahneus ASIC to BT module.

CLK600. The clock source is an internal RC oscillator in EM ASIC N2300 (during the power-up sequence) or RAPIDO SMPS Clk.

Sys Clk. The Sys Clock is used for the camera hardware accelerator (HWA, N3400).

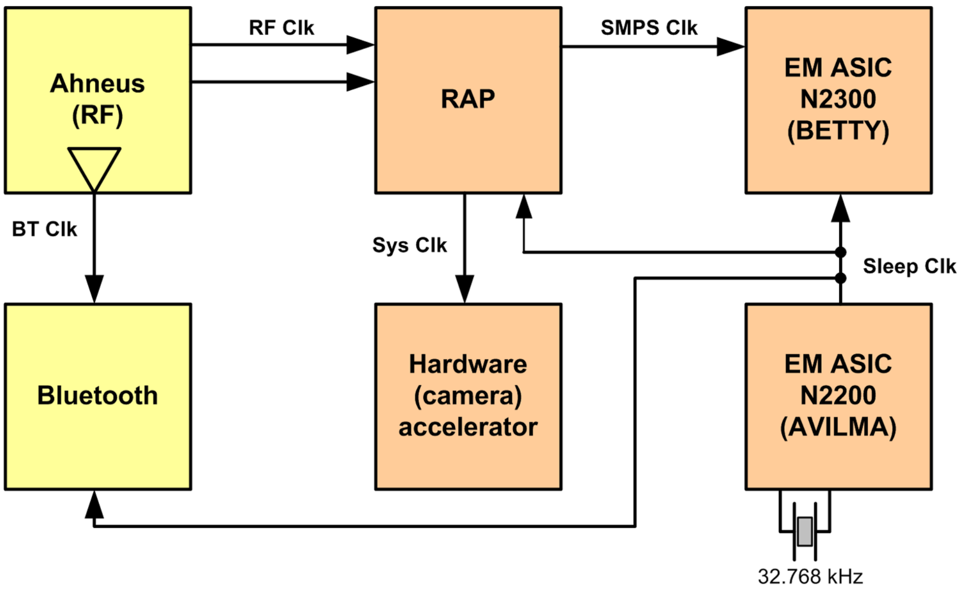

Ahneus
(RF)
RF Clk
RAP
SMPS Clk
EM ASIC
N2300
(BETTY)
BT Clk
Sys Clk
Sleep Clk
Bluetooth
Hardware
(camera)
accelerator
EM ASIC
N2200
(AVILMA)
32.768 kHz

Figure 22 Clocking scheme

USB, SIM, µSD, TV out

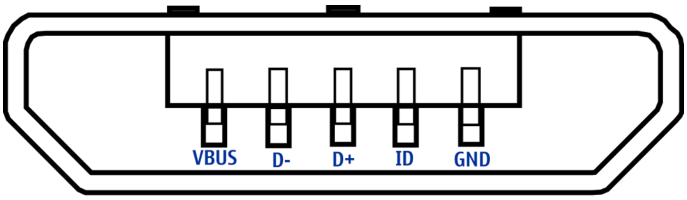
Micro USB

The micro USB (Universal Serial Bus) provides a wired connectivity between a PC and peripheral devices. It is a differential serial bus.

USB 2.0 is supported with full speed (12 Mbps).

Hot swap is supported, which means that USB devices may be plugged in/out at any time.

This phone is provided with a specific connector for µUSB.


VBUS
D-
D+
ID
GND

SIM interface

The device has one SIM (Subscriber Identification Module) interface. It is only accessible if battery is removed. The SIM interface consists of an internal interface between RAP and EM ASIC (N2200), and of an external interface between N2200 and SIM contacts.

The SIM IF is shown in the following figure:

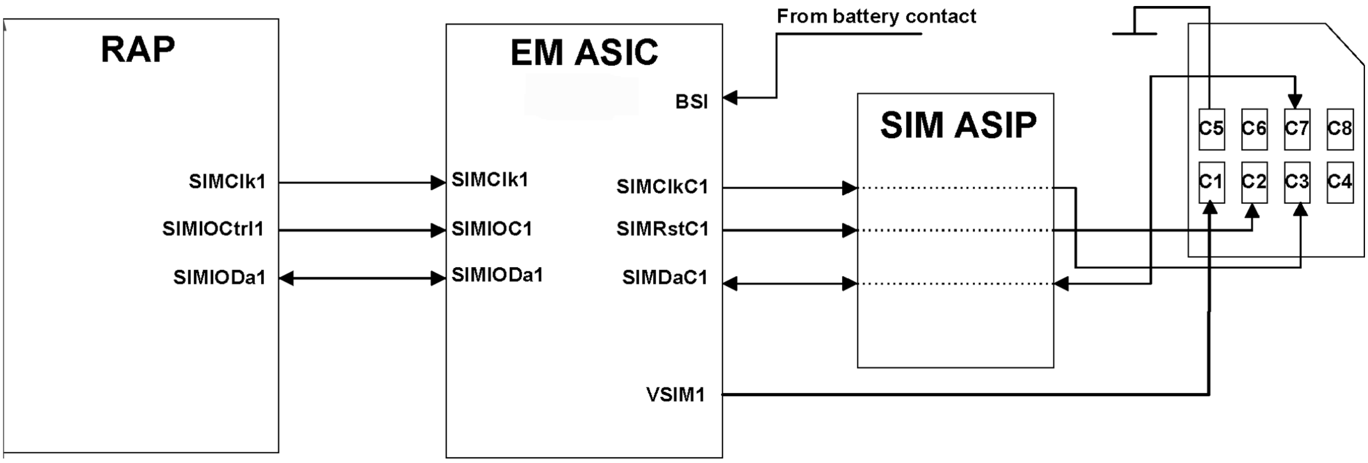
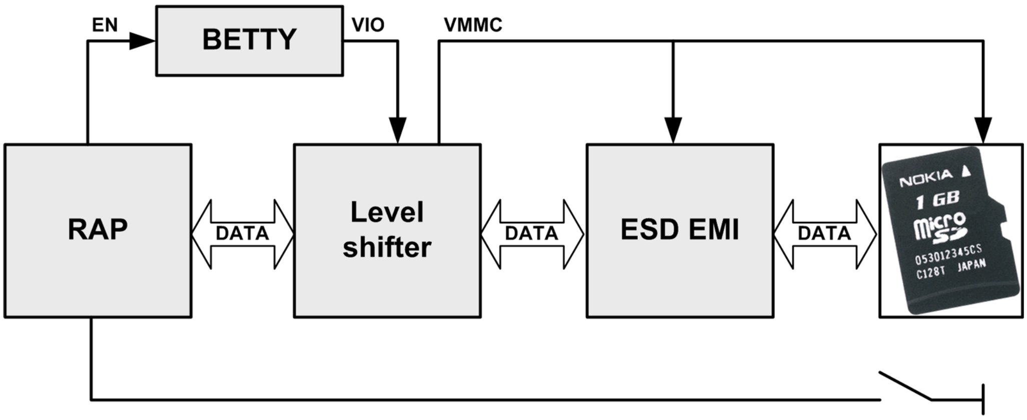

RAP
SIMClk1
SIMIOCtrl1
SIMIODa1
EM ASIC
BSI
SIMClk1
SIMIOC1
SIMIODa1
SIMClkC1
SIMRstC1
SIMDaC1
VSIM1
From battery contact
SIM ASIP
C5
C6
C7
C8
C1
C2
C3
C4

Figure 23 SIM interface

The EM ASIC handles the detection of the SIM card. The detection method is based in the BSI line. Because of the location of the SIM card, removing the battery causes a quick power down of the SIM IF.

The SIM interface supports both 1.8 V and 3.0 V SIM cards. The SIM interface voltage is first 1.8 V when the SIM card is inserted, and if the card does not response to the ATR a 3 V interface voltage is used.

µSD card interface


EN
BETTY
VIO
VMMC
RAP
DATA
Level shifter
DATA
ESD EMI
DATA
NOKIA
1 GB
micro SD
053012345CS
C128T JAPAN

The µSD card is connected to the engine by an external level shifter and ESD protection filter. Supplied voltages:

- VMMC: 2.85 V (from level shifter)
- VIO: 1.8 V (from AVILMA)

Camera concept

This phone has a main camera module with 3.2 megapixel camera. The camera has auto focus function in still mode. The auto focus is activated by pressing the dedicated camera button halfway down (the auto focusing result will be indicated in the viewer).

The auto focus range is from approximately 0.1meter to infinity. The lens movement from one extreme to the other is less than 0.5mm, which indicates that great care shall be taken when handling the main camera.

The camera is supported by a hardware accelerator (HWA - N3400) which also handles the camera flash function (double LED flash diodes).

The secondary camera is used for video calling and is basically handled in a similar way to the main camera.

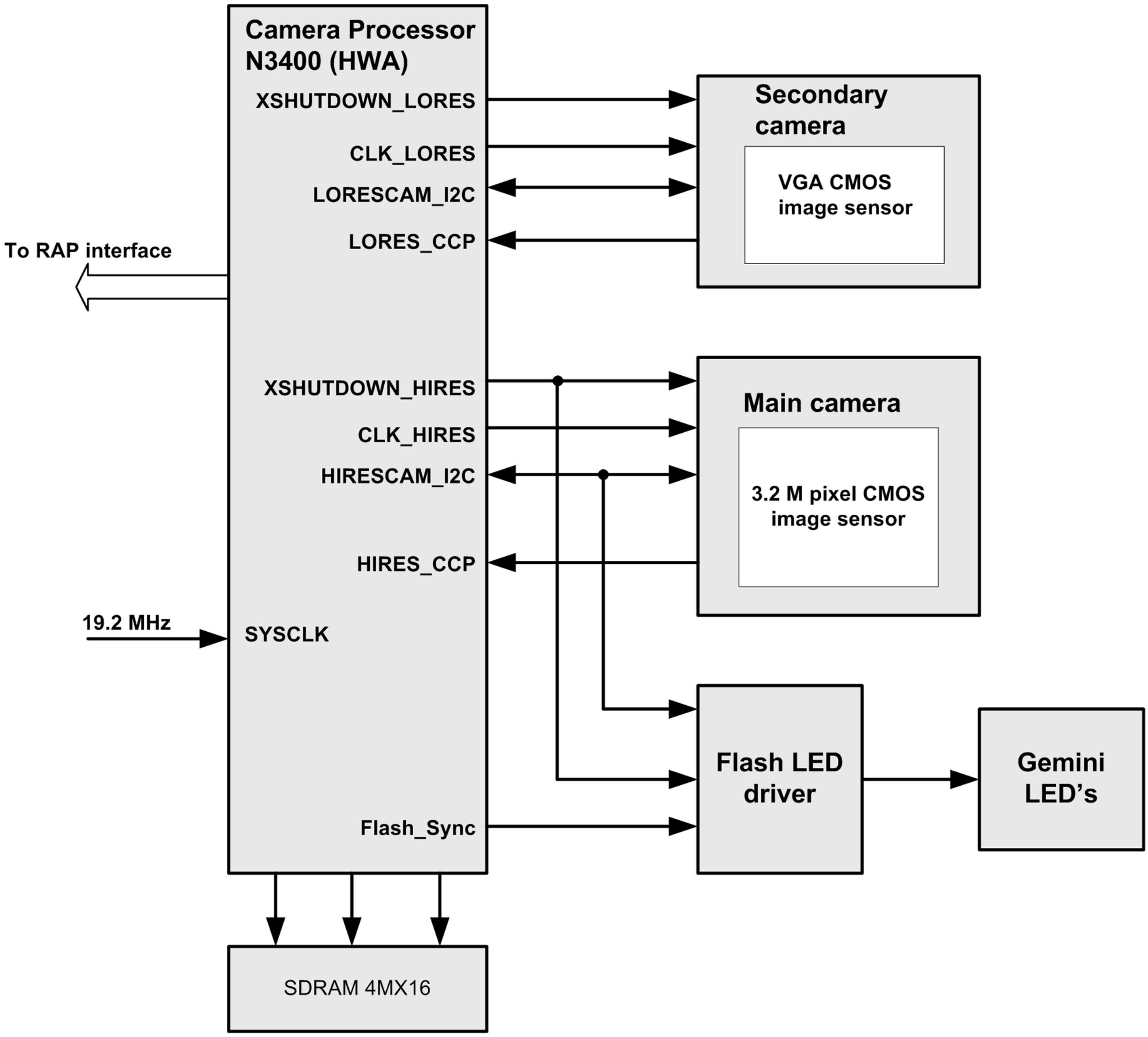

Camera Processor
N3400 (HWA)
XSHUTDOWN_LORES
CLK_LORES
LORESCAM_I2C
LORES_CCP
To RAP interface
XSHUTDOWN_HIRES
CLK_HIRES
HIRESCAM_I2C
HIRES_CCP
19.2 MHz
SYSCLK
Flash_Sync
Secondary camera
VGA CMOS image sensor
Main camera
3.2 M pixel CMOS image sensor
Flash LED driver
Gemini LED's
SDRAM 4MX16

Figure 24 Camera block diagram

User interface

Display module

The interconnection between the LCD module and the engine is implemented with a 24-pin board-to-board connector.

The LCD module does not require any tuning in service.

Keyboard and other keys

Table 8 Key signal matrix

GENIO		36	37	38	39	40
		KEYB_CMT8 (COL0)	KEYB_CMT9 (COL1)	KEYB_CMT10 (COL2)	KEYB_CMT11 (COL3)	KEYB_CMT12 (COL4)

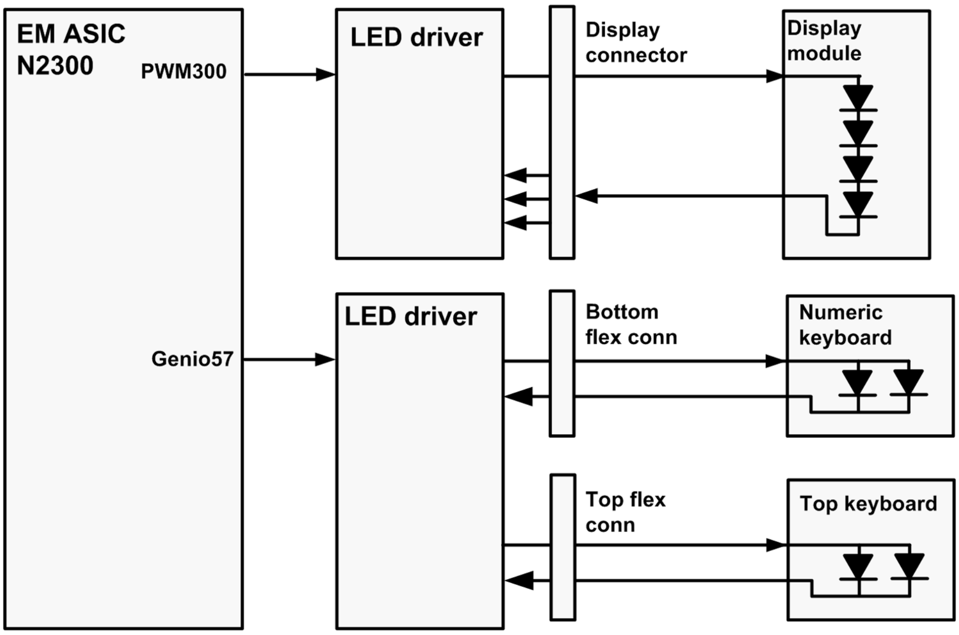
GENIO		36	37	38	39	40
32	KEYB_CMT0 (ROW0)	Soft left	Left	Soft right	Up	
33	KEYB_CMT1 (ROW1)	Send	Right	End	Select	
34	KEYB_CMT2 (ROW2)	1	2	3	Down	
35	KEYB_CMT3 (ROW3)	4	5	6	Vol+	
41	KEYB_CMT4 (ROW4)	7	8	9	Vol-	
42	KEYB_CMT5 (ROW5)	*	0	#	Camera capture	Auto focus

Backlight and illumination

There is backlight illuminating the display.

The lower/numeric keyboard is top lit by 2 LEDs, and the top keyboard is also lit by 2.

There is one driver for the display, and another for all keys.


EM ASIC
N2300
PWM300
Genio57
LED driver
LED driver
Display
connector
Bottom
flex conn
Top flex
conn
Display
module
Numeric
keyboard
Top keyboard

Ambient light sensor (ALS)

The ambient light sensor is used to control the back lights of the phone:

- Keyboard light is switched on only when environment is dark/dim
- Display backlights are dimmed when environment is dark/dim.

Slide switch

This is a slide phone that wakes up when it slides open. It is implemented with two hall sensors mounted on the main PWB and a magnet fitted to the sliding mechanism. The hall detector output is active low (0V) and 1.8V when not active. This arrangement makes the phone able to detect - closed and open position. The two hall sensors are overlapping each other to cover the entire sliding range.

Audio concept

Audio concept

This phone has a conventional solution on earpiece, internal hands free (IHF) and vibra. These are all handled by AVILMA N2200. The microphone is digital and the filtered input is feed directly to RAP D2800 for processing.

Since this phone has focus on audio playback, it contains improved circuits for audio handling. The DAC33 is a special audio processing ASIC that offers better signal to noise ratio than conventional circuits. This improves the playback audio quality significantly. The playback audio (e.g. music stored in the phone or on the micro USB) is processed from RAP D2800 via DAC33 and an amplifier to the AV-connector (for e.g. headset). The DAC33 contains a FIFO memory that can store up to 85ms of playback time (allowing D2800 to go to sleep mode and save energy). The entire audio playback circuits are optimized to save energy and improve audio quality and the energy saving is quite significant (more than 50%, which means longer playback time than in a conventional design).

The Plug detector (PLUG_DET) in the AV connector enables the external microphone, when the phone function is used. The headset earphones will still be processed via DAC33 (without using the power saving mode). The audio quality will to some extent be improved (saying other links in the audio chain doesn't have the same high quality as the playback channel has).

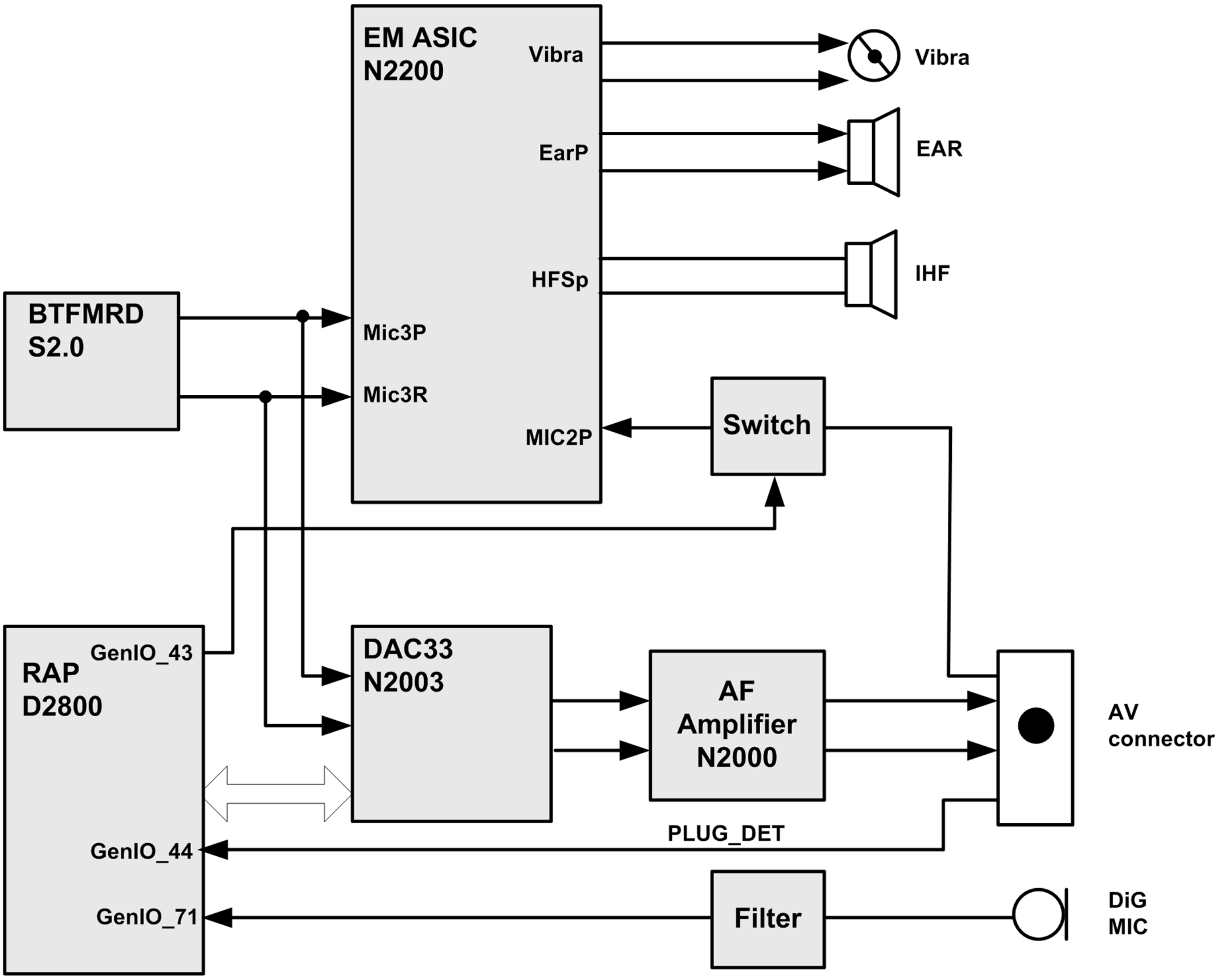

EM ASIC
N2200
Vibra
Vibra
EarP
EAR
HFSp
IHF
BTFMRD
S2.0
Mic3P
Mic3R
MIC2P
Switch
RAP
D2800
GenIO_43
DAC33
N2003
AF
Amplifier
N2000
AV
connector
PLUG_DET
GenIO_44
GenIO_71
Filter
DiG
MIC

Figure 25 Audio block diagram

The Plug detector (PLUG_DET) in the AV connector enables the external microphone, when the phone function is used. The headset earphones will still be processed via DAC33 (without using the power saving mode). The audio quality will to some extent be improved (saying other links in the audio chain doesn't have the same high quality as the playback channel has).

AV connector

The AV connector is used to connect headsets both in the handsfree phone function and for using the phone as a media player (see the audio concept heading). The six pins are used in accordance with the table below.

A connected male connector is detected on pin 6 (PLUG_DET).

Note: Only use an approved cable for connecting to the AV connector (e.g. headset HS-45).

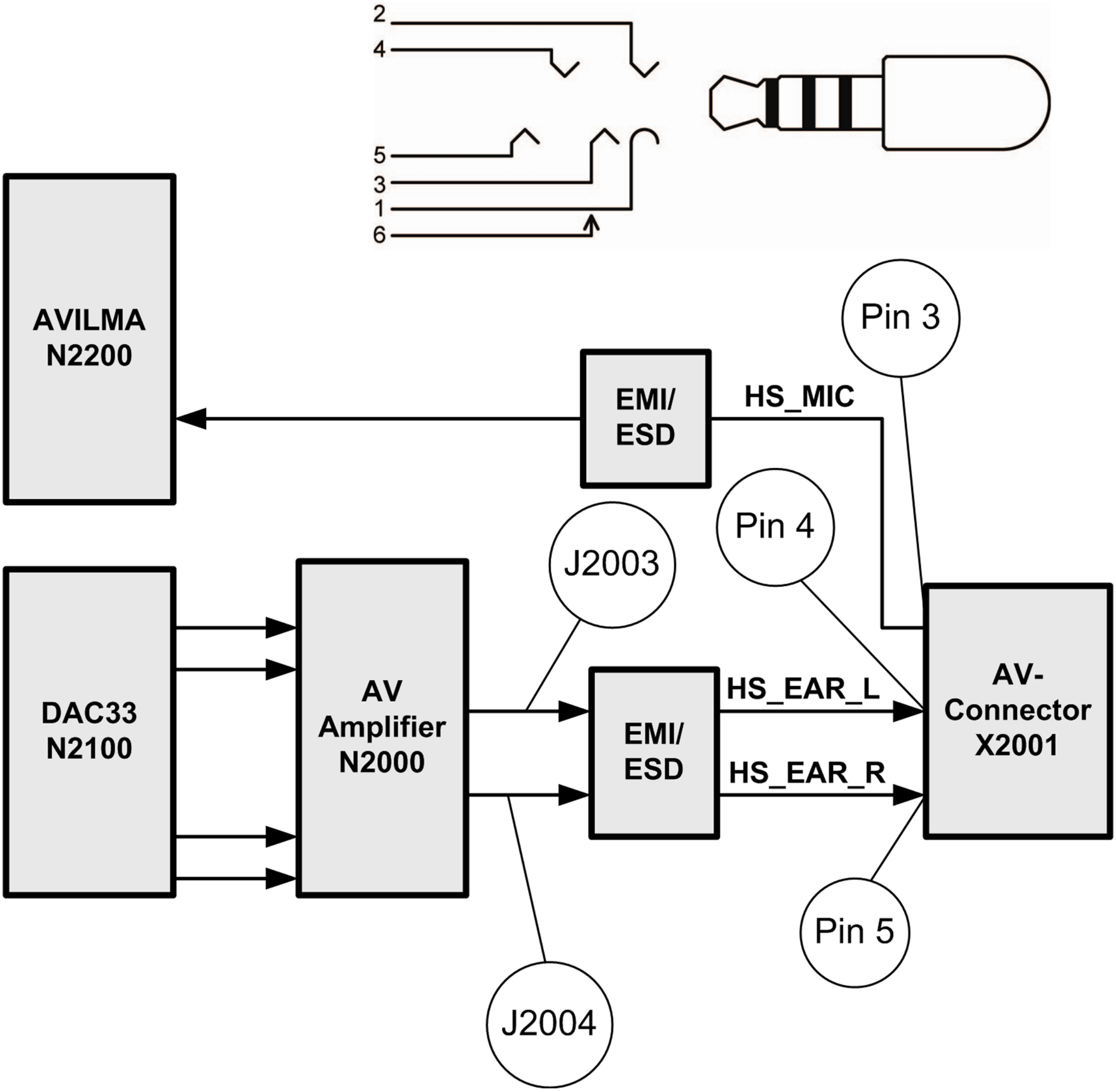

2
4
5
3
1
6
AVILMA N2200
Pin 3
EMI/ ESD
HS_MIC
Pin 4
J2003
DAC33 N2100
AV Amplifier N2000
EMI/ ESD
HS_EAR_L
HS_EAR_R
AV-Connector X2001
Pin 5
J2004

Table 9 AV connector pins

Pin	Signal name	Direction	Description
1, 2	HS_ GND	-	Ground)
3	HS_MIC	Input	Microphone
4	HS_EAR_R	Output	Audio out
5	HS_EAR_L	Output	Audio out
6	PLUG_DET	Input	Plug detection

RF description

Bluetooth

Bluetooth provides a fully digital link for communication between a master unit (the phone) and one or more slave units (e.g. a wireless headset). Data and control interface for a low power RF module is provided by the module.

The Bluetooth is physically integrated with the FM radio into one single module. From a functional point of view they, however, have nothing in common.

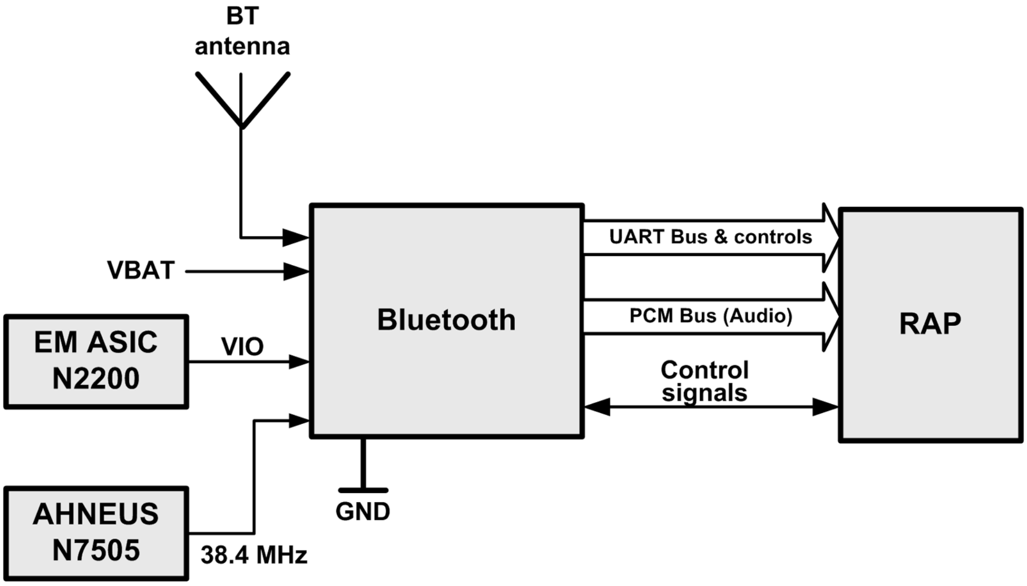


Figure 26 Bluetooth interface

The Bluetooth has a separate built in antenna and is powered by VBAT and the regulated voltage VIO. For audio applications the Bluetooth has a PCM data bus. In addition a UART (universal asynchronous receiver/ transmitter) is used for data communication and controls.

FM radio

The FM radio is physically integrated with the Bluetooth into one single module. From a functional point of view they, however, have nothing in common.

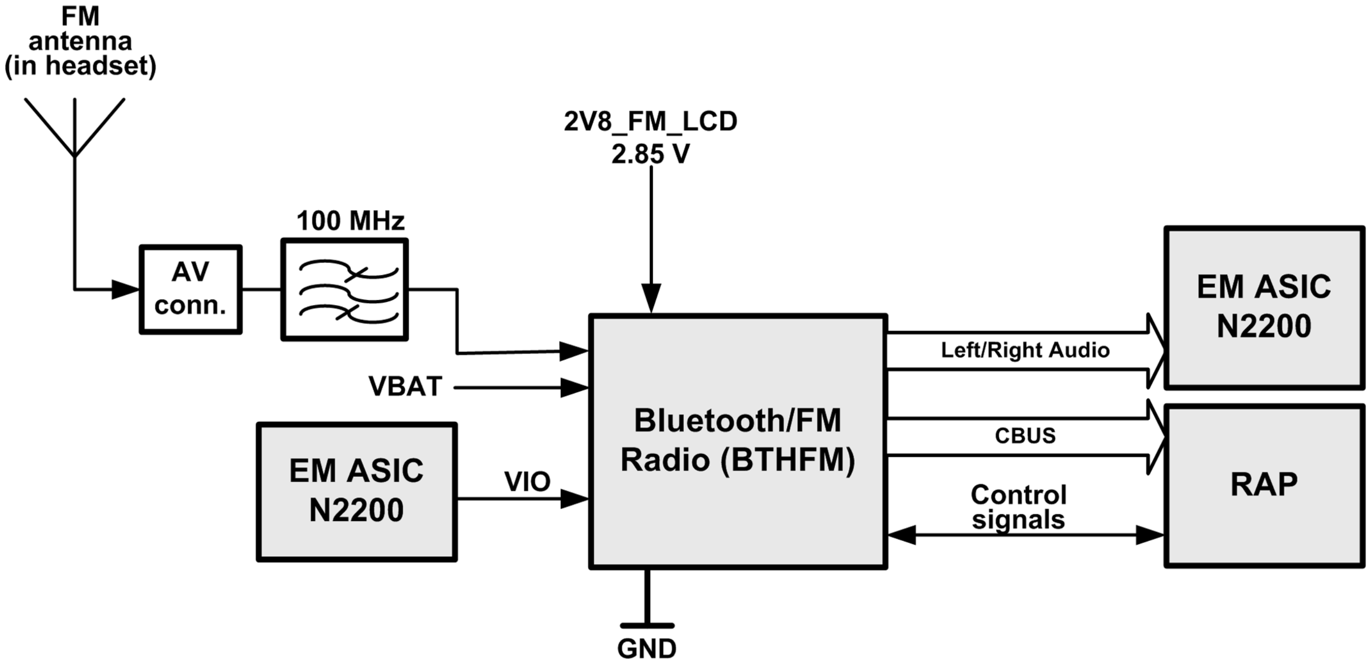

FM antenna (in headset)
AV conn.
100 MHz
2V8_FM_LCD 2.85 V
VBAT
EM ASIC N2200
VIO
Bluetooth/FM Radio (BTHFM)
GND
Left/Right Audio
CBUS
Control signals
EM ASIC N2200
RAP

Figure 27 FM interface

The FM radio is an integrated circuit, controlled by MCU software through a serial bus interface. The wires of the headset are used as poles of the antenna, and no other antenna is needed for FM radio reception.

In addition to the Bluetooth unit the FM radio is provided with LDO (low drop out) voltage 2V8_FM_LCD.

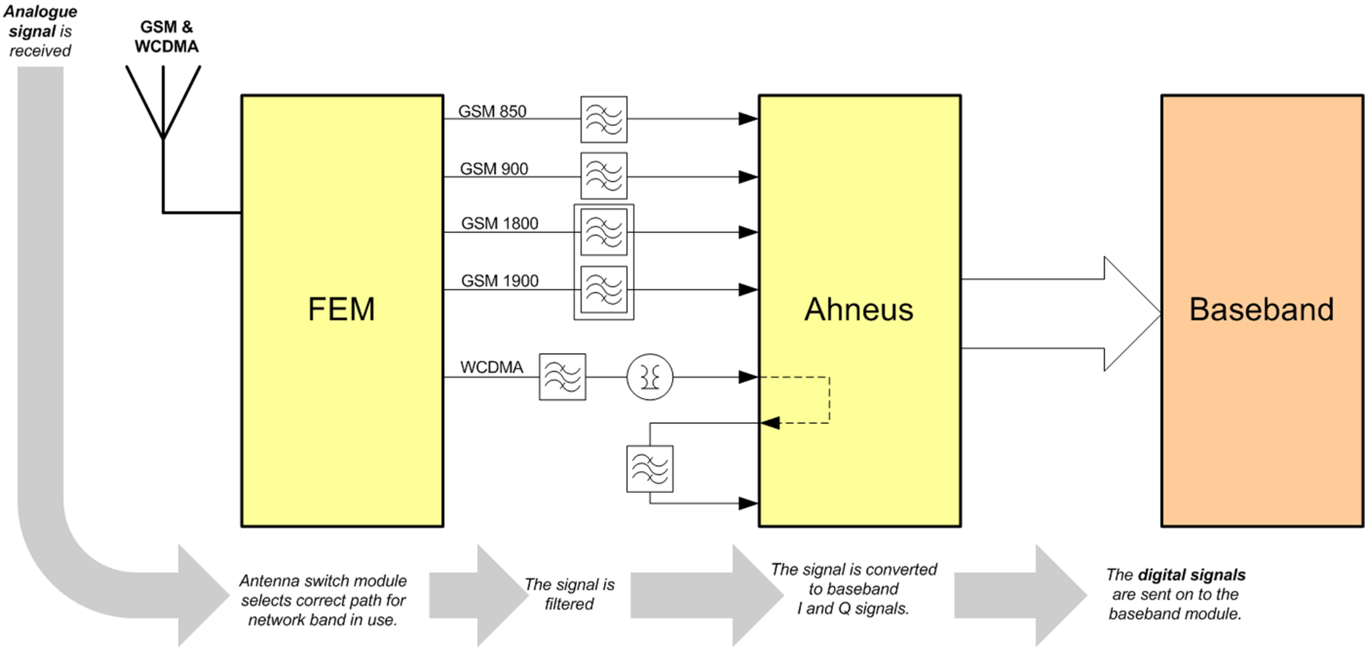
The radio has an automatic band search function, which can search for a strong write/read signal from a certain frequency. When this is found, data is transmitted to the radio. When the signal strength is low, the EM ASIC N2200 (AVILMA) can read data, which is available until the signal is strong again.

Receiver (RX)

An analogue signal is received by the phone's antenna. The signal is converted to a digital signal and is then transferred further to the baseband (eg. to the earpiece).

The receiver functions are implemented in the RF ASIC.

Signals with different frequencies take different paths, therefore being handled by different components. The principle of GSM and WCDMA is the same.

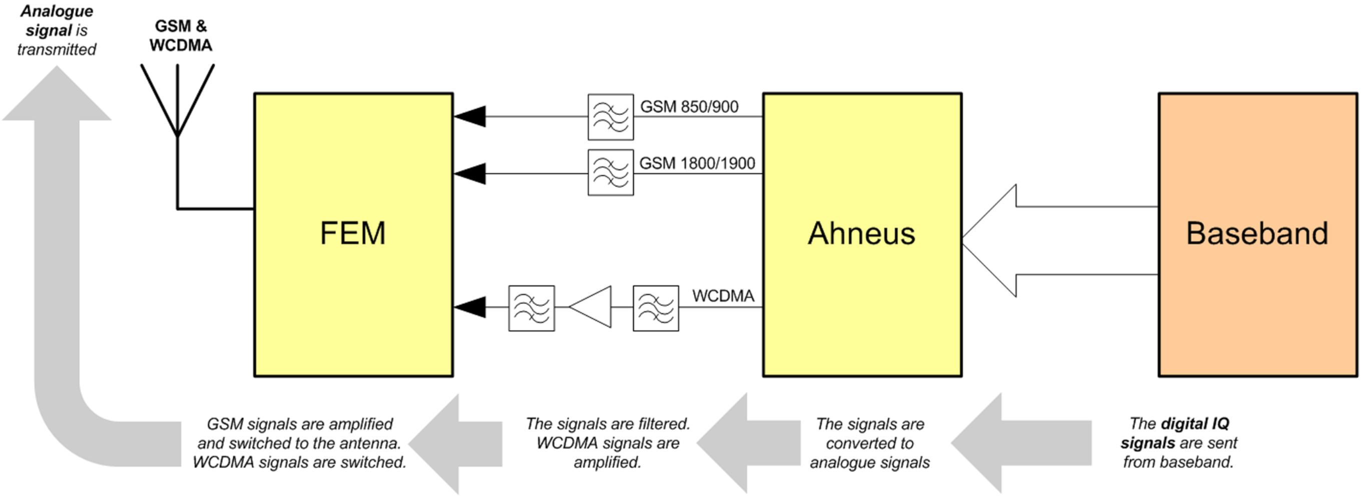

Analogue signal is received
GSM & WCDMA
FEM
GSM 850
GSM 900
GSM 1800
GSM 1900
WCDMA
Ahneus
Baseband
Antenna switch module selects correct path for network band in use.
The signal is filtered
The signal is converted to baseband I and Q signals.
The **digital signals** are sent on to the baseband module.

Transmitter (TX)

The digital baseband signal (eg. from the microphone) is converted to an analogue signal, which is then amplified and transmitted from the antenna. The frequency of this signal can be tuned to match the bandwith of the system in use (eg. GSM900).

The transmitter functions are implemented in the RF ASIC.

Even though the GSM and WCDMA signals are sent via different components, the principles of the transmission is the same.


Analogue signal is transmitted
GSM & WCDMA
FEM
GSM 850/900
GSM 1800/1900
WCDMA
Ahneus
Baseband
GSM signals are amplified and switched to the antenna. WCDMA signals are switched.
The signals are filtered. WCDMA signals are amplified.
The signals are converted to analogue signals
The **digital IQ signals** are sent from baseband.

Technical specifications

Main RF characteristics for GSM and WCDMA band phones

Parameter	Unit
Cellular system	EGSM850/900/1800/1900 + WCDMA band I/V

Parameter	Unit
RX frequency band	EGSM850: 869- 894 MHz
	EGSM900: 925- 960 MHz
	GSM1800: 1805 - 1880 MHz
	GSM1900: 1930 - 1990 MHz
	WCDMA band I: 2110 - 2170 MHz
	WCDMA band V: 869 - 894 MHz
TX frequency band	GSM850: 824- 849 MHz
	GSM900: 880- 915 MHz
	GSM1800: 1710 - 1785 MHz
	GSM1900: 1850 - 1910 MHz
	WCDMA band I: 1920 - 1980 MHz
	WCDMA band V: 824 - 849 MHz
Output power	GSM850: +5 ... +33 dBm
	EGSM900: +5 ... +33 dBm
	GSM1800: +0 ... +30 dBm
	GSM1900: +0 ... +30 dBm
	WCDMA band I: -50...+24 dBm
	WCDMA band V: -50...+24 dBm
Number of RF channels	GSM850: 124
	EGSM900: 172
	GSM1800: 375
	GSM1900: 300
	WCDMA band I: 277
	WCDMA band V: 108
Channel spacing	GSM 200 KHz WCDMA 4.8 MHz
Number of Tx power levels	GSM850: 15
	GSM900: 15
	GSM1800: 16
	GSM1900: 16
	WCDMA: 75

Environmental conditions

Environmental condition	Ambient temperature	Notes
Normal operation	-15 ºC ... +55 ºC	Specifications fulfilled
Reduced performance	55 ºC ... +70 ºC	Operational only for short periods
Intermittent or no operation	-40 ºC ... -15 ºC and +70 ºC ... +85ºC	Operation not guaranteed but an attempt to operate will not damage the phone
No operation or storage	<-40 ºC and >+85 ºC	No storage. An attempt to operate may cause permanent damage
Charging allowed	-15 ºC ... +55 ºC	
Long term storage conditions	0 ºC ... +85 ºC	
Humidity and water resistance		Relative humidity range is 5 to 95%. Condensed or dripping water may cause intermittent malfunctions. Protection against dripping water has to be implemented in (enclosure) mechanics. Continuous dampness will cause permanent damage to the module.

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Glossary

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A/D-converter	Analog-to-digital converter
ACI	Accessory Control Interface
ADC	Analog-to-digital converter
ADSP	Application DPS (expected to run high level tasks)
AGC	Automatic gain control (maintains volume)
ALS	Ambient light sensor
AMSL	After Market Service Leader
ARM	Advanced RISC Machines
ARPU	Average revenue per user (per month or per year)
ASIC	Application Specific Integrated Circuit
ASIP	Application Specific Interface Protector
B2B	Board to board, connector between PWB and UI board
BB	Baseband
BC02	Bluetooth module made by CSR
BIQUAD	Bi-quadratic ,type of filter function)
BSI	Battery Size Indicator
BT	Bluetooth
CBus	MCU controlled serial bus connected to UPP_WD2,UEME and Zocus
CCP	Compact Camera Port
CDSP	Cellular DSP (expected to run at low levels)
CLDC	Connected limited device configuration
CMOS	Complimentary metal-oxide semiconductor circuit (low power consumption)
COF	Chip on Foil
COG	Chip on Glass
CPU	Central Processing Unit
CSR	cambridge silicon radio
CSTN	Color Super Twisted Nematic
CTSI	Clock Timing Sleep and interrupt block of Tiku
CW	Continuous wave
D/A-converter	Digital-to-analouge converter
DAC	Digital-to-analouge converter
DBI	Digital Battery Interface
DBus	DSP controlled serial bus connected between UPP_WD2 and Helgo
DCT-4	Digital Core Technology
DMA	Direct memory access
DP	Data Package

DPLL	Digital Phase Locked Loop
DSP	Digital Signal Processor
DtoS	Differential to Single ended
EDGE	Enhanced data rates for global/GSM evaluation
EGSM	Extended GSM
EM	Energy management
EMC	Electromagnetic compability
EMI	Electromagnetic interference
ESD	Electrostatic discharge
FCI	Functional cover interface
FPS	Flash Programming Tool
FR	Full rate
FSTN	Film compensated super twisted nematic
GMSK	Gaussian Minimum Shift Keying
GND	Ground, conductive mass
GPIB	General-purpose interface bus
GPRS	General Packet Radio Service
GSM	Group Special Mobile/Global System for Mobile communication
HF	Hands free
HFCM	Handsfree Common
HS	Handset
HSCSD	High speed circuit switched data (data transmission connection faster than GSM)
HW	Hardware
I/O	Input/Output
IBAT	Battery current
IC	Integrated circuit
ICHAR	Charger current
IF	Interface
IHF	Integrated hands free
IMEI	International Mobile Equipment Identity
IR	Infrared
IrDA	Infrared Data Associasion
ISA	Intelligent software architecture
JPEG/JPG	Joint Photographic Experts Group
LCD	Liquid Crystal Display
LDO	Low Drop Out

LED	Light-emitting diode
LPRF	Low Power Radio Frequency
MCU	Micro Controller Unit (microprocessor)
MCU	Multiport control unit
MIC, mic	Microphone
MIDP	Mobile Information Device Profile
MIN	Mobile identification number
MIPS	Million instructions per second
MMC	Multimedia card
MMS	Multimedia messaging service
NTC	Negative temperature coefficient, temperature sensitive resistor used as a temperature sensor
OMA	Object management architechture
OMAP	Operations, maintenance, and administartion part
Opamp	Operational Amplifier
PA	Power amplifier
PDA	Pocket Data Application
PDA	Personal digital assistant
PDRAM	Program/Data RAM (on chip in Tiku)
Phoenix	Software tool of DCT4.x and BB5
PIM	Personal Information Management
PLL	Phase locked loop
PM	(Phone) Permanent memory
PUP	General Purpose IO (PIO), USARTS and Pulse Width Modulators
PURX	Power-up reset
PWB	Printed Wiring Board
PWM	Pulse width modulation
RC-filter	Resistance-Capacitance filter
RF	Radio Frequency
RF PopPort TM	Reduced function PopPortTM interface
RFBUS	Serial control Bus For RF
RSK	Right Soft Key
RS-MMC	Reduced size Multi Media Card
RSSI	Receiving signal strength indicator
RST	Reset Switch
RTC	Real Time Clock (provides date and time)

RX	Radio Receiver
SARAM	Single Access RAM
SAW filter	Surface Acoustic Wave filter
SDRAM	Synchronous Dynamic Random Access Memory
SID	Security ID
SIM	Subscriber Identity Module
SMPS	Switched Mode Power Supply
SNR	Signal-to-noice ratio
SPR	Standard Product requirements
SRAM	Static random access memory
STI	Serial Trace Interface
SW	Software
SWIM	Subscriber/Wallet Identification Module
TCXO	Temperature controlled Oscillator
Tiku	Finnish for Chip, Successor of the UPP
TX	Radio Transmitter
UART	Universal asynchronous receiver/transmitter
UEME	Universal Energy Management chip (Enhanced version)
UEMEK	See UEME
UI	User Interface
UPP	Universal Phone Processor
UPP_WD2	Communicator version of DCT4 system ASIC
USB	Universal Serial Bus
VBAT	Battery voltage
VCHAR	Charger voltage
VCO	Voltage controlled oscillator
VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator
VCXO	Voltage Controlled Crystal Oscillator
Vp-p	Peak-to-peak voltage
VSIM	SIM voltage
WAP	Wireless application protocol
WD	Watchdog
XHTML	Extensible hypertext markup language
Zocus	Current sensor, (used to monitor the current flow to and from the battery)